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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AXON ENTERPRISE, INC., DEDRONE HOLDINGS, INC.,
AND SKYDIO, INC.

Petitioners

v.

AIRSPACE DEFENSE, INC.

Patent Owner

Case No. IPR2025-00629
Patent 10,514,711

REMOTE ORAL DEPOSITION OF
DR. NIKOLAOS PAPANIKOLOPOULOS
FEBRUARY 26, 2026

ORAL DEPOSITION of DR. NIKOLAOS
PAPANIKOLOPOULOS, produced as a witness at
the instance of the Petitioners, and duly
sworn, was taken in the above-styled and
numbered cause on February 26, 2026, from
9:04 a.m. to 2:13 p.m., before Mendy A.
Schneider, CSR, RPR, in and for the State of
Texas, recorded by machine shorthand,
remotely at the offices of MENDY SCHNEIDER,
LLC, The Woodlands, Texas, pursuant to the
Federal Rules of Civil Procedure and the
provisions stated on the record or attached
hereto; that the deposition shall be read and
signed.

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EXAMINATION INDEX

WITNESS: DR. NIKOLAOS PAPANIKOLOPOULOS

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EXHIBIT INDEX

(No exhibits were marked.)

(REPORTER'S NOTE: All quotations from documents are reflected in the manner in which they were read into the record and do not necessarily denote an exact quote from the document.)

1 THE REPORTER: The attorneys
2 participating in this deposition
3 acknowledge that I am not physically
4 present in the deposition room and
5 that I will be reporting this
6 deposition remotely.

7 They further acknowledge that,
8 in lieu of an oath administered in
9 person, I will administer the oath
10 remotely.

11 The parties and their counsel
12 consent to this arrangement and waive
13 any objections to this manner of
14 reporting.

15 DR. NIKOLAOS PAPANIKOLOPOULOS,
16 having been first duly sworn, testified as
17 follows:

18 EXAMINATION

19 BY MR. WALTERS:

20 Q. Good morning, Dr. Nikos.

21 A. Good morning.

22 Q. Could you please state your

1 name for the record.

2 A. Nikolaos Papanikolopoulos.

3 Q. And is there any reason that
4 you cannot testify truthfully at this
5 deposition today?

6 A. No.

7 Q. What did you do to prepare for
8 today's deposition?

9 A. I just reviewed my declaration
10 and whatever I reference in my declaration as
11 prior art patent and so on and so forth.

12 Q. Did you review any documents
13 other than those referenced in your
14 declaration?

15 A. No.

16 Q. Did you meet with anyone?

17 A. I met with my counsel.

18 Q. With whom did you meet?

19 A. Suhrid Wadekar.

20 Q. Anyone else?

21 A. We talked briefly with Matt
22 Vella, another counsel in the case.

1 Q. Anyone else?

2 A. Not that I recall.

3 Q. When did that meeting occur?

4 A. We met a couple of times in
5 middle February. And yesterday.

6 Q. Were those meetings in person?

7 A. Regarding my counsel, yes.
8 Matt was remote.

9 Q. In middle of February, you met
10 in person?

11 A. Yes.

12 Q. About how long total did you
13 meet with counsel to prepare for today's
14 deposition?

15 A. For all three depositions, it
16 is around 25 hours, 30 hours.

17 Q. Okay. And about how much
18 additional time did you spend on your own
19 preparing for today's deposition?

20 A. Around 10 -- 10, 15 hours.

21 Q. At what rate are you being
22 compensated for your deposition today?

1 A. At my standard rate of \$500 an
2 hour.

3 Q. Is that the same rate that
4 you're being compensated that -- for your
5 other time in this matter?

6 A. Yes.

7 Q. You've submitted a declaration
8 in this proceeding?

9 A. Yes.

10 Q. It's Exhibit 2025?

11 A. Yes.

12 Q. Is everything in that
13 declaration accurate?

14 A. To the best of my knowledge.

15 Q. I'd like to turn to your
16 declaration, Exhibit 2025.

17 A. Just give me a minute.

18 Again, for the record, I have a
19 hard copy, and I have also the central
20 repository of all the documents that I was
21 sent. So do you want me to go to a
22 particular page or?

1 Q. You have a hard copy of your
2 declaration in front of you?

3 A. Yeah.

4 Q. Do you have any other hard copy
5 documents in front of you?

6 A. No. That's -- that's the only
7 one.

8 Q. And the declaration is a clean
9 version?

10 A. Yes.

11 Q. And then you have access to
12 electronic copies of the other filings and
13 exhibits used in this IPR proceeding?

14 A. That's correct.

15 Q. Okay. Do you have access to
16 the other documents?

17 A. No. I have removed everything
18 from my...

19 Q. I'd like to turn to exhibit
20 Page 50 and Paragraph 107 of your
21 declaration.

22 A. Just give me a minute.

1 107, you said?

2 Q. Yes.

3 A. Sure.

4 Q. In this section, you discussed
5 proposed substitute claim 21?

6 A. That's correct.

7 Q. Can you turn to Paragraph 115.

8 A. Yes.

9 Q. And this paragraph discusses
10 Limitation 21.d?

11 A. That's correct.

12 Q. And in the middle of this
13 limitation, it recites: "Wherein performing
14 the flight control operation includes
15 determining a speed adjustment factor based
16 on a magnitude of deviation of a direction of
17 the three-dimensional relative location."

18 You see that?

19 A. That's correct.

20 Q. What is a speed adjustment
21 factor?

22 A. Give me a minute to go to the

1 spec, the support table.

2 (Reporter clarification.)

3 A. Support table supporting the
4 specification.

5 Bear with me one minute.

6 (BY MR. WALTERS)

7 Q. No problem.

8 A. So if you go to the
9 Exhibit 2019, this is on Page 57. 2019 I
10 believe is the application. "Modifying the
11 speed and/or acceleration associated with the
12 vector includes -- includes adjusting a
13 factor used to control the speed and/or
14 acceleration of the interceptor aerial
15 vehicle based on an amount" --

16 (Discussion off the record.)

17 A. Exhibit 2019 Paragraph 99:
18 "Modifying the speed and/or acceleration
19 associated with the vector includes adjusting
20 a factor used to control the speed and/or
21 acceleration of the interceptor aerial
22 vehicle based on an amount of directional

1 change specified by the vector. For example,
2 when a large directional change is required
3 by the interceptor aerial vehicle to fly
4 towards the target, a slower speed is
5 desirable to allow the directional change to
6 take place at the slower speed over a certain
7 distance as compared to a faster speed that
8 is desirable to reach the target quicker
9 where no or minor directional change is
10 required.

11 "In some embodiments the speed
12 and all acceleration factors multiplied by
13 one or more scale of values, that change in
14 magnitude varies on the direction deviation
15 of the vector or on the current direction of
16 movement."

17 (BY MR. WALTERS)

18 Q. You've quoted directly from the
19 specification?

20 A. That's correct, from -- from
21 two -- Exhibit 2019.

22 Q. Are the words "speed adjustment

1 factor" used in that quote?

2 A. Yes.

3 Q. Is the term "speed adjustment
4 factor" used in that quote?

5 MS. L'ESPERANCE: Objection;
6 asked and answered.

7 A. Yes.

8 (BY MR. WALTERS)

9 Q. Where so?

10 A. Adjusting a factor used to
11 control the speed.

12 Q. Can you elaborate on what a
13 speed adjustment factor is beyond the quote
14 that you quoted from Paragraph 99?

15 A. I think the spec, also, it says
16 in some embodiments the speed and
17 acceleration factor is multiplied by one or
18 more scale of values.

19 Q. That's also a direct quote from
20 Paragraph 99?

21 A. Exactly.

22 Q. Can you elaborate on what a

1 speed adjustment factor is other than
2 directly quoting from Paragraph 99?

3 MS. L'ESPERANCE: Objection;
4 asked and answered.

5 A. I just answered. I think
6 this -- it says the factor that is used to
7 control the speed.

8 (BY MR. WALTERS)

9 Q. Can you turn to Paragraph 127
10 of your declaration.

11 A. Give me a minute.

12 That's correct, I'm there.

13 Q. This section discusses
14 substitute claim 25.

15 Do you see that?

16 A. That's correct.

17 Q. And substitute claim 25 depends
18 from claim 21 that we were just discussing?

19 A. That's correct.

20 Q. And claim 25 requires wherein
21 performing the flight control operation
22 includes determining a speed adjustment

1 factor based on the determined distance to
2 the target?

3 A. That's correct.

4 Q. So this claim 25 required
5 determining two speed adjustment factors, the
6 first recited in claim 21 and the second
7 recited in dependent claim 25?

8 A. Give me a minute.

9 The -- the one in 21, the claim
10 language is basically that the speed
11 adjustment factor is based on the magnitude
12 of deviation of a direction of the
13 three-dimensional relative location.

14 And the factor in 25 determine
15 a speed adjustment factor based on the
16 determined distance to the target.

17 One is the direction, and the
18 other one is the determined distance.

19 Q. So is it fair to say that
20 claim 25 read in the context of claim 21
21 requires determining two speed adjustment
22 factors?

1 A. We shouldn't forget that speed
2 is a vector, has a direction and a magnitude.

3 Q. So I'll ask my question again.
4 Is it fair to say that claim 25
5 read in the context of claim 21 requires
6 determining two speed adjustment factors?

7 A. Or an adjustment factor that
8 refers to the -- to the speed vector.

9 As I replied earlier, there is
10 a magnitude and direction.

11 Q. Is it your position that the
12 speed adjustment factor recited in claim 25,
13 which says "determining a speed adjustment
14 factor based on the determined distance to
15 the target," could be the same speed
16 adjustment factor that was determined in
17 claim 21?

18 A. It's a possibility, but if we
19 look at the spec for the 25, Exhibit 2019,
20 Paragraph 97: "...a vector identifying the
21 relative location of the target is determined
22 using at least the determined relative

1 direction of the target."

2 "In one example, the vector is
3 defined by the azimuth angle, the altitude
4 angle, and a factor based on an associate
5 distance or speed."

6 "In some embodiments, the
7 vector is at least in part defined using a
8 distance and/or speed value. For example,
9 the distant value determined in 502 is mapped
10 to a desired speed of travel to reach the
11 target (for example, greater speed desired
12 for further distance and slower speed desired
13 for shorter distance to allow more time for
14 direction correction)."

15 Q. In what scenario would the
16 speed adjustment factor that is determined in
17 dependent claim 25 be the same speed
18 adjustment factor that's determined in
19 claim 21?

20 A. In an interception scenario.
21 So we have a drone that we want to track, so
22 this is an interceptor drone that uses the

1 autonomous navigation with all the processing
2 happening on board, and it has a target drone
3 that tries to follow.

4 As the drone moves in 3D space,
5 then we have the location and the direction.
6 And the drone uses these adjustment factors
7 in order to follow it.

8 Q. Earlier you testified that a
9 speed adjustment factor is the factor that is
10 used to control the speed, correct?

11 A. With the speed? Let me -- the
12 speed associated -- let me read it exactly
13 the claim language.

14 So determining a speed
15 adjustment factor based on a magnitude of
16 deviation of a direction of the
17 three-dimensional relative location.

18 Q. Earlier I asked you can you
19 elaborate on what a speed adjustment factor
20 is other than directly quoting from
21 Paragraph 99, and you answered: "It says the
22 factor that is used to control the speed."

1 Do you recall that?

2 A. That's correct.

3 Q. But what is -- what is a
4 factor?

5 A. A mathematical quantity or a
6 set of quantities.

7 Q. Is a scalar value a speed of
8 adjustment factor?

9 A. Possibly. But since it's 3D,
10 it may be a vector.

11 Q. Are -- are you saying that the
12 factor could be a scalar or a vector?

13 A. The terms are used
14 interchangeably. But if we want to be
15 mathematically correct, it's generally a
16 factor -- I would say the terms are used
17 interchangeably. I will leave it there.

18 Q. The terms are used
19 interchangeably where?

20 A. In my -- based on my
21 experience. I have been working in tracking
22 for 30 years.

1 Q. Okay. I didn't know if you
2 were referring to the spec or just your
3 industry knowledge.

4 A. I started with the spec, and I
5 complemented the spec with my experience.

6 Q. Are the terms "scalar" and
7 "vector" used interchangeably in the
8 specification?

9 A. The specification is using
10 these adjustment factors for speed.

11 Q. Yeah. So my question was: Are
12 the terms -- you testified earlier that the
13 terms "scalar" and "vector" are used
14 interchangeably in the industry.

15 And my question is: Are the
16 terms "scalar" and "vector" used
17 interchangeably in the specification?

18 A. The specification talks about
19 an adjustment factor.

20 Q. Okay. I understand that.

21 But are the terms "scalar" and
22 "vector" used interchangeably in the

1 specification?

2 A. I don't recall. Let me -- let
3 me look for a minute.

4 If you go in 2019,
5 Paragraph 99, it talks -- this is Page 57 of
6 my declaration.

7 "In some embodiments, the speed
8 and/or acceleration factor is multiplied by
9 one or more scalar values that change in
10 magnitude based on a directional deviation of
11 the vector from a current direction of
12 movement."

13 And if you go -- so that's one
14 example of where the scalar is used.

15 Q. Just for clarification, when
16 you refer to page numbers in your
17 declaration, are you referring to the exhibit
18 page number or the larger page number at the
19 bottom of the page?

20 A. I'm using -- for the previous
21 one, I'm using one I mentioned -- let me see.

22 If you look at the

1 Exhibit 2025, it's Page 61 of the exhibit,
2 but the page number in the middle is
3 Page No. 57.

4 Q. Thank you.

5 And on that page you were
6 quoting from, you were quoting directly from
7 the application that is quoted --

8 A. Correct.

9 Q. -- in the declaration?

10 A. Yes.

11 Q. Are "scalar" and "vector"
12 another term for factor?

13 A. Can you repeat, please, the
14 question.

15 Q. Are "scalar" and "vector" other
16 terms for factor?

17 A. A vector has scalar values.

18 Q. Are they terms for factor?

19 A. Either independent scalar
20 components or the whole vector.

21 Q. Is a factor?

22 A. Can be a factor.

1 Q. Can you turn back to
2 Paragraph 115 of your declaration, exhibit
3 Page 60?

4 A. Sure.
5 I'm there.

6 Q. As we discussed earlier, this
7 section discusses Limitation 21.d, and it
8 includes the limitation wherein performing
9 the flight control operation includes
10 determining a speed adjustment factor based
11 on a magnitude of deviation of a direction of
12 the three-dimensional relative location.

13 You see that?

14 A. That's correct.

15 Q. Can you turn to Paragraph 145
16 of your declaration, which is exhibit
17 Page 74.

18 A. I am there.

19 Q. This paragraph discusses
20 substitute claim 31, correct?

21 A. That's correct.

22 Q. And this claim depends from

1 claim 21 that we were just discussing?

2 A. That's correct.

3 Q. Okay. You see that in claim 31
4 there's a limitation wherein performing the
5 flight control operation includes scaling a
6 speed adjustment factor?

7 A. That's correct.

8 Q. Is this a new speed adjustment
9 factor or a different speed adjustment factor
10 that's recited in independent claim 21 from
11 which claim 31 depends?

12 MS. L'ESPERANCE: Objection;
13 form.

14 A. I think the support here is
15 pretty clear. Let me read from the support.
16 So is Exhibit 21 -- 2019 Paragraph 91:
17 "...the three-dimensional vector specifies
18 directional and speed/acceleration changes to
19 be performed by the interceptor aerial
20 vehicle to direct the flight path of the
21 interceptor aerial vehicle at a desired rate
22 of change towards the target aerial vehicle."

1 Paragraph 98: "At 508 the
2 vector is scaled. In some embodiments,
3 scaling the vector includes modifying the
4 speed and/or acceleration associated with the
5 vector as well as moving and limiting the
6 rate of change associated with the vector."

7 "In some embodiments, the
8 factor used to control the speed and/or
9 acceleration of the interceptor aerial
10 vehicle includes limiting its rate of change
11 and/or value (either by reduction scalar or a
12 maximum change limit)."

13 In other words, the scaling
14 here refers to an operation of changing the
15 speed adjustment factor because you want to
16 have a smooth trajectory or you may want to
17 have a speed on the rate of change, a speed
18 limit, and limit the rate of change in order
19 to avoid operating the drone at its
20 operational limits. You don't want to excite
21 the harmonics of the system.

22

1 (BY MR. WALTERS)

2 Q. Claim 21 recites determining a
3 speed adjustment factor, correct?

4 A. That's correct.

5 Q. And claim 31 from which --
6 strike that.

7 Claim 31 that depends from
8 claim 21 recites "scaling a speed adjustment
9 factor," correct?

10 A. That's correct.

11 Q. Is claim 31 requiring two speed
12 adjustment factors in that case, the first
13 recited in claim 21 and the second recited in
14 claim 31?

15 A. We're talking about the
16 adjustment factor as it's stated as disclosed
17 in claim 21.

18 Q. So the speed adjustment factor
19 that's scaled in claim 31 is the same speed
20 adjustment factor that is determined in
21 claim 21?

22 MS. L'ESPERANCE: Objection;

1 asked and answered.

2 A. It uses the claim 21. So
3 basically it refers to the same speed
4 adjustment factor and just describes --
5 there's another disclosure, in order to have
6 a smooth flight and also have some limits on
7 how fast the change of speed may happen.

8 Q. I missed your answer.

9 Did you say that the speed
10 adjustment factor in claim 31 is the same
11 speed adjustment factor that's determined in
12 claim 21?

13 MS. L'ESPERANCE: Objection;
14 asked and answered. Mischaracterizes.

15 A. What I said is actually the
16 claim 31 depends on claim 21 where a specific
17 speed adjustment -- where a speed adjustment
18 factor is mentioned and 31 adds an additional
19 disclosure or a claim element where it talks
20 about scaling the speed adjustment factor in
21 order to have a smooth tracking -- "tracking"
22 is my word -- and limit a rate of change.

1 (BY MR. WALTERS)

2 Q. Is the -- is the speed
3 adjustment factor that is scaled in claim 31
4 the same speed adjustment factor that is
5 determined in claim 21?

6 MS. L'ESPERANCE: Objection;
7 asked and answered.

8 A. I just am going to repeat the
9 previous answer.

10 (BY MR. WALTERS)

11 Q. Go ahead.

12 A. That the claim 31 depends on
13 claim 21, and here it adds the claim element
14 wherein performing the flight control
15 operation includes scaling a speed adjustment
16 factor to smooth and limit a rate of change
17 of a speed of the reference aerial vehicle.

18 Q. And is the speed adjustment
19 factor that's scaled the same speed
20 adjustment factor that is determined in
21 claim 21 or is it a new speed adjustment
22 factor?

1 MS. L'ESPERANCE: Objection;
2 asked and answered.

3 A. I just repeat my previous
4 answer. It's -- it expands the claim 1
5 [verbatim] by having -- it mentions in the
6 spec a smoothing and limiting operation.
7 (BY MR. WALTERS)

8 Q. So if the board is interested
9 in this question of whether the speed
10 adjustment factor that is scaled in 31 is the
11 same or different from the speed adjustment
12 factor that is determined in claim 21, what
13 would be your answer to the board?

14 A. Can you repeat the question.

15 Q. Sure.

16 If the board is interested in
17 the question of whether the speed adjustment
18 factor that is scaled in claim 31 is the same
19 or different from the speed adjustment factor
20 that is determined in claim 21, what would be
21 your answer to the board?

22 A. My answer to the board is

1 contained in my declaration and in the
2 analysis that I'm doing in the support in the
3 specification and factor -- I read the
4 paragraph that summarizes the Paragraph 147
5 from my declaration.

6 Says: "A factor used to
7 control the speed and to scale the vector to
8 modify the speed to avoid sudden changes in
9 the speed is an adjustment factor that
10 smooths and limits the rate of change of the
11 reference aerial vehicle speed. Thus, the
12 '452 application teaches the limitations
13 recited in proposed substitute claim 31."

14 If we scale an adjustment
15 factor, a speed adjustment factor, the result
16 of scaling is an adjustment -- a speed
17 adjustment factor as well.

18 Q. Okay. I'm going to make one
19 more effort at -- at having you answer the
20 question because you haven't answered it yet.
21 Okay?

22 And -- and this testimony will

1 go to the board.

2 So claim 21 recites determining
3 a speed adjustment factor.

4 Do you understand that?

5 A. That's correct.

6 Q. And claim 31 recites scaling a
7 speed adjustment factor.

8 Do you understand that?

9 A. That's correct.

10 Q. Is the speed adjustment factor
11 that's scaled in claim 31 the same or
12 different than the speed adjustment factor
13 that is determined in claim 21?

14 A. And I repeat the same answer.
15 It just -- it explains how actually we can
16 have an additional processing step as
17 disclosed in claim 21. There is a claim
18 element that involves the smoothing or
19 limiting this speed adjustment factor by
20 using this scaling operation.

21 Q. So can you not tell me whether
22 it's the same or different than the speed

1 adjustment factor that is recited in claim 21
2 and determined in claim 21?

3 A. I just repeat -- I just repeat
4 the -- whatever is discussed in the -- in my
5 declaration. And I explain in my experience
6 we don't want to have a speed adjustment
7 factor that is not smooth. And this is
8 exactly what is disclosed here that you want
9 to have the scheme that's going to enable
10 this smoothing and limiting of the adjustment
11 in the rate of change associated with a
12 vector.

13 In my opinion, the
14 specification is very clear of the operation
15 that is done.

16 Q. Let's look at Paragraph 170 of
17 your declaration on exhibit Page 86.

18 A. Which paragraph you mention?

19 Q. 170.

20 A. Yes, I'm there.

21 Q. This paragraph discusses
22 Limitation 36.d.

1 Do you see that?

2 A. That's correct.

3 Q. And 36(d) recites: "Wherein
4 the detecting of the target in the image is
5 performed using a neural network at a first
6 robustness and a first compute cost..."?

7 A. That's correct.

8 Q. And then later in the
9 limitation, it discusses a second robustness
10 and a second compute cost?

11 A. That's correct.

12 Q. What is a robustness?

13 A. Give me a minute.

14 So if you go at exhibit, we are
15 on the same page, Exhibit 2019,
16 Paragraph 110. I'm reading from the
17 supporting specification entry. "Once an
18 object is detected in high-resolution mode
19 using DNN or" --

20 (Discussion off the record.)

21 THE WITNESS: Yeah.

22 A. So: "Once an object is

1 detected in high-resolution mode (for
2 example, using DNN or manual input) a tracker
3 algorithm takes control and maintains lock on
4 the target. Applying different tracking
5 algorithms and DNN based detections of a
6 target in the video frame provides robustness
7 at the high compute costs. A reduced source
8 resource background tracker may incrementally
9 predict the location of a target in the frame
10 with low compute costs and average
11 robustness."

12 So it's referring to the
13 robustness -- high robustness or average
14 robustness.

15 (BY MR. WALTERS)

16 Q. What is robustness?

17 A. I think the -- the
18 specification here discusses robustness in
19 terms of accuracy of the detection.

20 Q. Robustness refers to accuracy?

21 A. Based on my experience.

22 Q. Is "robustness" an industry

1 term?

2 A. Yes.

3 Q. How is robustness measured?

4 A. It's measured, for example,
5 with respect to ground truth. You may have
6 robustness which says how many false
7 detections you have, so, in other words, you
8 may detect something that doesn't exist. You
9 may not detect something that exists. And
10 how many times you may be successful with
11 respect to the appearance or disappearance of
12 a target.

13 Q. Higher success or higher
14 accuracy equals higher robustness?

15 A. That's correct.

16 Q. What is a compute cost?

17 A. A compute cost is the time in
18 milliseconds or seconds that you need in
19 order to perform this detection.

20 So since at the time we were
21 talking, which is roughly ten years ago, on
22 board processors they have limited resources.

1 And I believe here is disclosed
2 a pretty novel approach where you have one
3 neuron network that comes at a higher cost
4 but provides robustness, increased
5 robustness.

6 And in order to avoid using
7 this continuously and creating an extra
8 burden on the processor, of the onboard
9 processor, which is contained within the
10 airframe, you can switch based on some
11 confidence measures, which is described in
12 another claim, to something that has lower
13 compute cost and average robustness.

14 Q. Does the higher compute cost
15 means that it takes longer?

16 A. Exhibit 2019 talks at
17 Paragraph 145: "Processing schemes can be
18 grouped as:

19 "High cost (low refresh rate),
20 high robustness algorithm."

21 In other words, the refresh
22 rate may be -- instead of milliseconds may be

1 a minute and continues and says: "Low costs,
2 high refresh rate."

3 So basically you do this every
4 3 or 4 milliseconds. And low robustness
5 algorithms.

6 And this is in the
7 Exhibit 1001, is described in Column 27, Rows
8 53 to 64.

9 And I have the support. I
10 don't know if you want me to continue.

11 There are further explanations
12 in the support in the specification, high
13 costs, low refresh rate.

14 I'm on Page 87, but has in the
15 middle of Page No. 83 where the spec at
16 Paragraph 151, Exhibit 2019, it says:
17 "Processing scheme examples for a group (ii)
18 and (iii) can include SqueezeNet super fast
19 rejection CNN as the validation method."

20 152: "Group (iii) Low-cost -
21 low robustness...can include: extrapolation
22 of location of object from past locations."

1 And so on and so forth.

2 Q. Earlier you testified that a
3 compute cost is the time in milliseconds or
4 seconds that you need in order to perform the
5 detection.

6 You recall that?

7 A. That's correct.

8 Q. So my question is: Is a --
9 does a higher compute cost take longer time
10 or shorter time?

11 A. A higher compute cost takes
12 longer time, which is critical for this
13 example. Because, again, we're talking about
14 a drone that tries to keep another drone in
15 full view based on information from a camera
16 which is mounted to the reference aerial
17 vehicle that follows the rogue drone.

18 Q. What is the refresh rate?

19 A. Refresh rate, it's how often
20 you get new images and how often --
21 another -- another way you can look at it is
22 actually what is the rate that the controller

1 updates its control actions based on the
2 visual information.

3 Q. Is your understanding of
4 refresh rate based on your industry
5 knowledge?

6 A. The industry knowledge is --
7 comes after reading the specifications. So
8 it's the secondary factor.

9 Q. Staying with Limitation 36.d --

10 A. Sure.

11 Q. -- in the middle -- in the
12 middle of this limitation, it recites: "The
13 determining of the three-dimensional relative
14 location of the target in the image comprises
15 incrementally predicting the location of the
16 target in the image."

17 Do you see that?

18 A. That's correct.

19 Q. What does it mean to
20 incrementally predict the location?

21 A. So if we go to the support
22 table in the specification: "A reduced

1 resource background tracker may incrementally
2 predict the location of a target in the frame
3 with low compute cost and average
4 robustness."

5 Q. Yeah. I understand that that
6 portion uses the words "incrementally
7 predict," but it doesn't tell me what it
8 means.

9 Can you tell me what the word
10 "incrementally predict" means?

11 MS. L'ESPERANCE: Objection;
12 form. Argumentative.

13 A. Incrementally predict -- I'm
14 not sure I -- I think --

15 (Discussion off the record.)
16 (BY MR. WALTERS)

17 Q. Should I just ask the question
18 again?

19 A. Sure.

20 Q. Okay. The -- the portion that
21 you quoted from the specification uses the
22 words "incrementally predict," but they don't

1 say what -- what the term means. And I'm
2 asking you what the term "incrementally
3 predict" means.

4 A. I think the tracker -- I
5 mean -- is doing in steps, increments.
6 Instead of one step, you have incremental
7 prediction of the location.

8 Q. Okay. And so if a system
9 predicted a location and then updated the
10 predicted location based on a particular
11 refresh rate, would that be incrementally
12 predicting a location?

13 A. It's a possibility, among many
14 others.

15 Q. So that would satisfy the term
16 "incrementally predicting a location"?

17 A. I have to see the full context
18 to say.

19 Q. It might satisfy the term?

20 A. I don't want to render an -- an
21 opinion unless I see -- you see, the tracking
22 we're talking here is a pretty complex

1 process.

2 Think of the following, we're
3 flying at speeds which may be, I will say,
4 200 miles an hour, a drone that has an aerial
5 system -- a reference aerial system 100 that
6 has a camera following another drone,
7 potentially a rogue drone, by using the
8 camera mounted and the computational
9 resources within this reference aerial
10 vehicle in order to look this rogue code and
11 codes drone.

12 So it's -- it's extremely
13 challenging. I think that's the novelty
14 here.

15 In order -- instead of doing
16 like the same rate of operation, you try to
17 use things that do not require much
18 computational power in order to keep the
19 target locked. And from time to time, you
20 use another neural network, as the claim
21 discloses, in order, basically, to have a
22 refinement of your prediction and keep the

1 target drone locked.

2 Q. What does it mean for an
3 algorithm to have a low refresh rate versus a
4 high refresh rate?

5 A. I'm going, again, to the spec.
6 This is Page 86 and Page 82 in the center of
7 the document where it says: "High costs, low
8 refresh rate, high robustness algorithms."
9 Low costs, high refresh rate, low robustness
10 algorithms. And this is the Exhibit 1001
11 Column 27, Rows 53, 64.

12 Q. Can you tell me what it means
13 for an algorithm to have a low refresh rate
14 versus a high refresh rate beyond quoting
15 from the specification?

16 A. I think I mentioned an example
17 earlier, something in the order of
18 3 milliseconds or 4, 5 milliseconds is high
19 refresh rate.

20 If we're talking about
21 something that in order to refresh takes a
22 minute or a day, is the low refresh rate.

1 Q. Can you elaborate on that in
2 terms of an algorithm?

3 A. So I can give you an example.

4 Let's suppose that we try to do
5 tracking with a genetic algorithm. The cycle
6 to execute one cycle can take up -- at that
7 time we're talking here, 2015. At that time
8 it may take a couple of days. Something like
9 this cannot work in the tracking experiment
10 that we're talking about.

11 That's why I believe it's
12 novel.

13 Q. Okay. I guess I don't follow
14 what you're trying to explain, and maybe
15 that's my issue.

16 But -- but I'm interested in
17 your explanation for what it means for an
18 algorithm to have a low refresh rate versus a
19 high refresh rate beyond simply quoting from
20 the specification.

21 A. So it says high cost. So in
22 other words, it takes longer to compute.

1 Let's suppose it takes a day to
2 compute. It means the refresh rate, the rate
3 by which you issue the control commands and
4 you get new images, it may be after a day.

5 In this case, you can
6 understand or even a minute that the target
7 will be lost because I won't have the ability
8 to follow the target.

9 If I have a high refresh rate
10 at a low cost, computational cost, in the
11 order of milliseconds I may be able to lock
12 the target with the disclosure of the
13 structure of the two neural networks which
14 are used.

15 Q. Is refresh rate directly
16 dependent on the compute cost?

17 A. On the total system cost.

18 For example, the acquisition of
19 images, the processor you have, the image bus
20 structure, how you transfer the images, how
21 do you store the images, how do you
22 manipulate the training of the neural network

1 because these are two essential elements of
2 the claim.

3 Q. Yeah. The reason I ask the
4 question is you said that a high compute cost
5 might take a day to compute.

6 A. And -- sorry to interrupt.
7 Just finish and I will --

8 Q. Yeah. In which case the
9 refresh rate you might get new images after a
10 day.

11 So that made me think that the
12 refresh rate was dependent on the compute
13 cost. And that's my question: Is the

14 refresh rate dependent on the compute cost?

15 A. Let me think a little bit and
16 try to explain this.

17 So the refresh rate in the
18 spec, it refers, based on the spec,
19 processing schemes can be grouped out. So
20 processing schemes are basically
21 characterized by the low refresh rate at a
22 high cost.

1 So in other words, if you look
2 at the cycles of these processing schemes --
3 and I think the spec is referring to this how
4 often these processing schemes produce new
5 control actions on how basically we're going
6 to correct the movement of the reference
7 aerial vehicle with respect to the locked
8 target.

9 Q. Would a high cost -- strike
10 that.

11 Would a high compute cost
12 necessarily mean a low refresh rate?

13 A. Among other things, yes.

14 Q. Would a low compute cost
15 necessarily mean a high refresh rate?

16 A. Among other things.

17 MR. WALTERS: We've been going
18 about an hour. Would it be a good
19 time to take a ten-minute break?

20 THE WITNESS: That's fine with
21 me.

22 MR. WALTERS: And you

1 understand, Dr. Nikos, that the IPR
2 rules prohibit you from discussing the
3 substance of your testimony with your
4 counsel during breaks?

5 THE WITNESS: I do.

6 MR. WALTERS: Thank you.

7 (Break from 10:05 a.m. to 10:16 a.m.)

8 (BY MR. WALTERS)

9 Q. Welcome back, Dr. Nikos.

10 A. Thank you.

11 Q. Does a -- if -- if one --
12 strike that.

13 If a first neural network had
14 more layers than a second neural network,
15 does the first neural network have a higher
16 compute cost than the second neural network?

17 A. Are you referring to the same
18 paragraph or in general?

19 Q. In general.

20 A. It depends on the -- on many
21 factors.

22 Q. What factors?

1 A. How the network is implemented,
2 if you have hidden nodes, the training.

3 Q. Would you expect the neural
4 network that had higher number of layers to
5 have a higher compute cost or would you
6 expect it to have a lower compute cost?

7 A. It depends on the training.
8 The training is -- is a critical part.

9 Now, if you go overboard and
10 you have many, many layers, of course it's
11 going to be higher cost.

12 Q. What if the first neural
13 network had more neurons than the second
14 neural network, would you expect it to have a
15 higher compute cost?

16 A. I think if we go to the spec
17 provide some evidence because it mentions --
18 give me one minute.

19 So I'm on Page 87 of -- of my
20 declaration Exhibit 2025. Support in the
21 specifications says: "Processing scheme
22 examples for a group. High costs (low

1 refresh rate) -- high robustness can include
2 modified tiny You only look once (YOLO)
3 Convolutional Neural Networks on 448 pixels
4 input tiles in the frame."

5 So one issue that is critical
6 here, you have to look at the size of the
7 images, how is this being titled. And then
8 it mention a modify single shot detection,
9 CNN, of 300 pixels multiscale.

10 So there are too many factors
11 which come into play depending on the
12 different architectures which are disclosed
13 in the spec.

14 Q. So you don't know if a first
15 network having more neurons than a second
16 network would have a higher compute cost than
17 the second network?

18 A. Usually yes, but as I
19 mentioned, there are several other parameters
20 you need to take into consideration.

21 Q. Okay. What if the first neural
22 network had more interconnections than the

1 second neural network, would you expect the
2 first neural network to have a higher compute
3 cost than the second neural network?

4 A. Possibly.

5 Q. Would you expect that first
6 neural network to have a lower compute cost
7 than the second neural network?

8 A. Can you repeat the question.

9 Q. Sure. If the first neural
10 network had more interconnections than the
11 second neural network, would you expect the
12 first neural network to have a lower compute
13 cost than the second neural network?

14 MS. L'ESPERANCE: Objection;
15 scope.

16 A. So let me -- so I have the
17 whole -- so if you have more -- a network
18 with more interconnections versus a network
19 with a small number of interconnections, the
20 first network is going to have -- that's I --
21 I want to make sure I understand your
22 question.

1 (BY MR. WALTERS)

2 Q. Is the first network going to
3 have a higher or lower compute cost?

4 A. Usually higher, although the
5 interconnections is part of the training and
6 is not so much for the aerial time execution
7 that we're talking here.

8 Q. Can you turn to Exhibit 1001,
9 the '711 patent.

10 A. Yeah. Just give me a minute.
11 Let me upload it, if you don't mind.

12 Yeah. I have it.

13 Q. Can you go to Column 1,
14 Lines 34 to 37 of the '711 patent.

15 A. Give me a minute. Column 1 you
16 said. Yes. And where?

17 Q. Line 34.

18 A. Yes, I'm there.

19 Q. This portion states:

20 "Additionally, if communication between the
21 aerial vehicle and the flight controller is
22 lost or becomes unreliable, the aerial

1 vehicle may be unable to complete a desired
2 flight operation"?

3 A. That's correct.

4 Q. And this is discussing problems
5 that the '711 patent was trying to solve?

6 A. That's correct.

7 Q. And it describes loss of
8 communication between the drone and the
9 flight controller as a potential problem?

10 A. Among other issues.

11 Q. Can you go to Column 11.

12 A. Bear with me.

13 Yes.

14 Q. Specifically at Line 49.

15 A. Yes.

16 Q. This states: "The frequency
17 channel associated with Antenna 305a may
18 become noisy. In response to the frequency
19 channel associated with Antenna 305a becoming
20 noisy, the radio communication system may
21 switch to a frequency channel associated with
22 Antenna 305b."

1 You see that?

2 A. That's correct.

3 Q. Switching to a different
4 frequency channel is a way to overcome a lost
5 or unreliable communication issue.

6 Is that fair?

7 MS. L'ESPERANCE: Objection;
8 scope.

9 A. I have to see the larger
10 context.

11 (BY MR. WALTERS)

12 Q. What larger context?

13 A. I mean, are we talking about a
14 base station? Or we're talking about
15 communication between drones?

16 Because here if you read the --
17 further down, it says -- let me read it
18 just -- just to make sure of it.

19 So if you go to line -- same
20 column, Line 56: "The persistent systems
21 radio may communicate with one or more UAVs
22 and transmit via antennas 305b -- 305 --

1 305a, 305b and signal back to the source..."

2 So if you have -- let's suppose
3 the spec here is talking -- the segment we
4 discussed earlier in Column 1 is
5 communication with the central station.

6 Here it's communicating -- the
7 communication between drones in case, for
8 example, I need to have another interceptor
9 drone or I need to transmit data.

10 So changing channels may make
11 it clearer but if the drone basically is out
12 of reach for some reason, it's not going to
13 help. That's why I said it depends, the
14 context.

15 Q. The portion you just discussed
16 discusses a UAV communicating with another
17 UAV as an intermediary, correct?

18 A. It continues. It says: "For
19 example, another UAV may act as an
20 intermediary between UAV and a remote
21 server."

22 Q. And so communicating with

1 another UAV as an intermediary is also a way
2 to overcome an unreliable communication issue
3 with a remote server?

4 MS. L'ESPERANCE: Objection;
5 scope. Form.

6 A. Yes, but you have a -- you may
7 have authentication issue. You don't know if
8 this intermediary UAV -- so your risk of
9 basically sending viable secure confidential
10 information to a rogue UAV -- so there are
11 pros and cons like every engineering
12 decision.

13 (BY MR. WALTERS)

14 Q. If a first neural network had a
15 higher robustness than the second neural
16 network, would you expect the first neural
17 network to have a higher compute cost?

18 A. Normally, yes. You are
19 referring to the -- again, we go back to
20 the -- to the substitute claims, right, or in
21 general?

22 Q. Either.

1 A. With respect to the substitute
2 claims, yes. Normally yes.

3 Q. I'd like to look at the Beard
4 reference, which is Exhibit 1009.

5 A. Bear with me.
6 Can you please repeat the
7 number.

8 Q. 1009.

9 A. Okay. Yes, I have it.

10 Q. I'd look -- like to look at
11 Figure 5. But also in context of the
12 description in the Beard reference.
13 Specifically Beard at Column 7, Line 13.

14 A. Let me go first with the
15 Figure 5.

16 Yes, and then you want me to go
17 where?

18 Q. The discussion of Figure 5 in
19 Beard starts in Column 7, Line 13.

20 A. Yes.

21 Q. Figure 5 of Beard shows a UAV
22 100; is that right?

1 A. That's correct.

2 Q. And the UAV 100 includes a
3 camera 210 and an image sensor 212?

4 A. Let me -- just a minute. An
5 actual -- in embodiments an action camera
6 system 200. Am I right? Which are the
7 sensors you are referring to?

8 Q. If you look at Figure 5 --

9 A. Oh, okay.

10 Q. -- UAV 100 includes a
11 camera 210 and an image sensor 212?

12 A. Yeah.

13 Q. It also includes a system bus
14 230?

15 A. That's true.

16 Q. And that system bus 230
17 includes image processing 234?

18 A. That's correct.

19 Q. And the image processing 234 is
20 on board the UAV?

21 A. Let me read the specifications.
22 Just give me one minute.

1 Yeah. It shows some
2 connection, but it's not clear if it is on
3 board or if is a mode server.

4 It's more -- so it's -- it's
5 got the whole box on Figure 5. It's
6 connected. The whole element 100 has an
7 arrow that points to the UAV.

8 Q. Are you suggesting that
9 camera 210 may not be on board the UAV?

10 MS. L'ESPERANCE: Objection;
11 mischaracterizes.

12 A. Just by looking at the fig --
13 the Figure 5, I've just described what it
14 shows. It shows a fractional block of
15 components 100 that is tied to the UAV.

16 (BY MR. WALTERS)

17 Q. Is it your opinion that
18 Figure 5 may show the camera 210 not being on
19 board the UAV?

20 MS. L'ESPERANCE: Objection;
21 asked and answered.

22 A. Let me read the specification.

1 In one embodiment -- so if you
2 look, for example, at Column 5, Line 51: "In
3 one embodiment, UAV 100 may adjust its angle
4 of elevation to target 118 via gimbals that
5 allow camera 210 to rotate or move relative
6 to the UAV. In one embodiment" -- so this is
7 another embodiment. This one doesn't say
8 that the camera is mounted.

9 In another embodiment, if the
10 camera 210 -- I'm continuing the same column:
11 "If the camera 210 is fixed relative to the
12 UAV, the actual camera system adjusts the
13 rotation -- the rotational orientation of UAV
14 (and thus the camera 210) by directing the
15 altitude control system."

16 So it has different
17 embodiments, but it's not always clear where
18 is the camera.

19 (BY MR. WALTERS)

20 Q. Does Figure 5 show that
21 camera 210 is co-located with system bus 230?

22 A. That's correct.

1 Q. Can you look at Column 7,
2 Line 28 of Beard?

3 A. Which one?

4 Q. Column 7, Line 28?

5 A. Yeah. Column 7, Line 28.

6 In one embodiment, that's --
7 that's the one you are --

8 Q. Yes.

9 A. "...processor 234 analyzes the
10 stream of images captured by camera 210 and
11 image sensor 212 to select a target and
12 determine optimal current orientations of the
13 target 118 to the UAV 100."

14 Q. So the image processor 234 of
15 Beard analyzes images captured by camera 210
16 and image sensor 212?

17 A. This is -- this what the
18 embodiment describes here.

19 Q. And that's to determine the
20 target 118 in the images?

21 A. According to this particular
22 embodiment.

1 And just to -- go and answer
2 the camera 210, there is a figure -- let
3 me -- bear with me one minute.

4 Yes, so I just tried to refresh
5 my memory.

6 Q. Anything further?

7 A. Can you repeat your question
8 again.

9 Q. I'm ready to move on to another
10 reference.

11 A. Okay. Sure.

12 Can I say something here with
13 respect to some -- if you see for example,
14 figure -- Figure 1, the human Figure 1C, 1D,
15 they're talking about a scenario which is
16 drastically different than the scenario for
17 drone tracking another drone having a camera
18 because all these humans are on the ground.

19 In other words, there is the
20 support which simplifies this is not
21 three-dimensional tracking as we do with the
22 drones.

1 And the word "neural network"
2 is not mentioned anywhere.

3 Q. Thank you.

4 Can we look at the Laufer
5 reference, which is Exhibit 1010.

6 A. May I remove this reference, or
7 you want me to keep it?

8 Q. You can remove it for now.

9 A. Okay. Can you please repeat
10 the exhibit number?

11 Q. 1010.

12 A. Yes, I'm there.

13 Q. Specifically at Paragraph 31.

14 A. Yes.

15 Q. About halfway down that
16 paragraph, Laufer discusses a drone
17 identification module 220.

18 Do you see that?

19 A. Yes. Drone identification
20 module 220.

21 Q. And in the -- in one sentence,
22 it states: "Drone identification module 220

1 can use video or image data from fixed
2 camera 130 and/or cameras mounted on
3 interceptor aircraft 140A-140B and/or data
4 from radars 110A-110C to determine whether a
5 detected target exhibits characteristics that
6 would indicate it was a threat."

7 A. That's correct.

8 Q. And then it states: "Machine
9 learning algorithms. For example, Deep
10 Convolutional Neural Network architectures
11 such as those available from OpenCV or
12 TensorFlow, can be used to classify whether a
13 target is a threat or not"?

14 A. On all the stuff is done at the
15 central controller 115, which is if you look
16 the central controller 115 is not on the
17 aerial vehicle. It's a ground station.

18 So if we go to figure --

19 Q. Did I read that portion
20 correctly of Laufer?

21 A. Yeah. I want to make a -- I
22 want to answer your question with respect

1 to -- so if you look at Figure 1, you can see
2 that 115 is connected -- is a ground station,
3 and there is several descriptions about this.

4 So one of the problems that I
5 highlighted with the staff is actually
6 contrary to what is disclosed, all the
7 processing happens outside the vehicle.

8 Q. You said you wanted to answer
9 my question. What question were you just
10 answering?

11 A. You asked me to read about the
12 neural networks and the imaging processing.

13 Q. Okay. The next sentence -- or
14 the last sentence in Paragraph 31 states:
15 "In some embodiments, the machine learning
16 algorithms can determine whether a target is
17 a drone and if the target is a drone whether
18 it is a threat." Correct?

19 A. That's correct. That's done by
20 the central controller 115.

21 Q. Is it fair to say that Laufer
22 teaches here that applying machine learning

1 to camera images is one way to identify a
2 drone in camera images?

3 A. I don't think it's an accurate
4 statement because we have -- so we have
5 static cameras with onboard processing, which
6 are mounted on the aerial vehicle, and we
7 have ground cameras where the processing is
8 done on the ground. So we need to be very
9 careful about these distinctions.

10 In fact, my whole Ph.D. thesis
11 look at why this is -- all these different --
12 differentiations.

13 So Laufer is using -- let me
14 go -- let me go to my -- to my report just to
15 make sure that I...

16 Bear with me one minute.

17 So, for example, if you go to
18 Paragraph 197 of my declaration, I am saying
19 that's in Laufer's, system it is: "The drone
20 identification module that may apply a
21 machine learning model/neural network. But,
22 in Laufer's system, the drone identification

1 module is part of the central controller 115.
2 As noted earlier, Laufer's 'central
3 controller 115 is connected to stationary
4 components of interdiction system 100 by a
5 wired'" -- and this is emphasized --
6 "'connection,' and 'can be connected to
7 interceptor aircraft 140A-140B through a
8 wireless connection.' Therefore, Laufer's
9 central controller is not part of and cannot
10 part of the UAV disclosed by a Laufer. As
11 such, Laufer does not teach or suggest
12 'applying a reference aerial vehicle a
13 machine learning model to the image,' as
14 proposed substitute claim 21 recites."

15 Q. Laufer does discuss applying
16 machine learning to identify a drone in --
17 from camera images?

18 MS. L'ESPERANCE: Objection;
19 asked and answered. Form.

20 A. Laufer discusses as part of the
21 central station 115 the central controller to
22 apply neural networks to do some type of

1 identification.

2 But as I mentioned earlier,
3 anyone who has some knowledge at that time
4 will understand that this is a completely
5 different system and problem formulation than
6 a whole -- the substitute claim, for example,
7 21 discusses.

8 (BY MR. WALTERS)

9 Q. Let's turn to Exhibit 1005.

10 A. Can you remind me the name?

11 Q. Pierce.

12 A. Just one minute.

13 Let me bring it back because I
14 erased it.

15 Yes.

16 Q. I would like to turn to
17 Paragraph 45 of Pierce.

18 A. Bear with me.

19 Yes, I'm there.

20 Q. In the middle of Paragraph 45,
21 Pierce discusses an object tracking
22 module 615.

1 Do you see that?

2 A. Yes.

3 Q. And Pierce states that:

4 "Captured images may be input into various
5 neural networks and/or computational systems
6 which may be implemented by object tracking
7 module 615."

8 Do you agree with that?

9 A. This is what it states, but I
10 have stated an opinion.

11 So let me start by in order to
12 answer this question, I think it's important
13 to put some perspective that the drone
14 system 600, at the beginning of Paragraph 45:
15 "Drone system 600 may further include
16 camera 605, global position system 607,
17 velocity detector 613, object tracking
18 module 615, and laser tracking module 617."

19 So -- and then lists some
20 embodiments.

21 I mean, they think this
22 discussion here is putting several components

1 together. For example, the laser tracking
2 module is going to be so power intensive.
3 Again, the compute stuff that we mentioned
4 and, also, the power requirements that, to
5 me, doesn't make any sense.

6 And then without any
7 description says, Oh, we can use a neural
8 network.

9 And I further highlight this in
10 my report.

11 So if you look at
12 Paragraph 199, I'm saying of my declaration:
13 "Pierce does not state that 'object detection
14 by a neural network' is performed on-board a
15 drone. Pierce also does not suggest such an
16 implementation, and instead, discloses a
17 drone system in which the neural network
18 based object detection is performed by a
19 'streaming server' that is separate from the
20 drone. Specifically, Pierce states that
21 'various elements of drone system 600 may
22 correspond to separate components, including

1 drone 102, a server" -- and it's bolded -- "a
2 controller, et cetera,' and that the 'drone
3 system 600...includes a processor 601,
4 memory 603, an interface...'"

5 And I want to say something
6 about this interface. "And may operate as a
7 streaming server."

8 This is Paragraph 42.

9 If you look, the interface 611
10 is typically configured to send and receive
11 data packets or data segments over the
12 network. This is 40 -- Paragraph 42. The
13 interface -- "'Particular examples' of the
14 interfaces 511 and 611 include 'Ethernet
15 interfaces, frame relay interfaces cable
16 interfaces, DSL interfaces.'"

17 This is Paragraph 39, 43. "All
18 of these are 'examples' of wired interfaces
19 that only a separate server, and not a
20 processor on-board a UAV, can support."

21 Q. Going back to Paragraph 45.

22 A. Can you repeat the question.

1 Q. Going back to Paragraph 45.

2 A. Yeah.

3 Q. The object tracking module 615
4 is described as analyzing camera images using
5 neural networks.

6 Is that fair?

7 A. This is what the words -- there
8 is no description. As I mentioned, this is
9 part of a larger system.

10 Q. Are you saying that's what the
11 words say?

12 A. Yeah. But if -- if you see I
13 mentioned that there are interfaces, other
14 components like laser tracking module and all
15 this stuff that all this indicate that the
16 neural network detection system is outside
17 the aerial vehicle.

18 Q. Can you look at Figure 6 of
19 Pierce.

20 A. Yes.

21 Q. Pierce shows that object
22 tracking module 615 is part of drone system

1 600?

2 A. That's correct.

3 Q. Can you look at Paragraph 42 of
4 Pierce.

5 A. But it has also the interface
6 611 for which I mentioned earlier that is
7 wired Ethernet interfaces, frame relay
8 interfaces, cable interface, DSL interface.

9 So you want me to go to which,
10 42?

11 Q. Yes.

12 A. Yes.

13 Q. Specifically the second
14 sentence of Paragraph 42. "Pierce states
15 that in various embodiments drone system 600
16 may be drone 102."

17 You see that?

18 A. That's correct.

19 Q. You agree that drone system 600
20 may be a drone in some embodiments in Pierce?

21 A. This is what the words say, but
22 again, as I mentioned earlier, the 600, it

1 has all these components which are hard
2 wired.

3 Q. When drone -- when drone system
4 600 is a drone in Pierce, is the object
5 tracking module 615 on the drone?

6 A. Can you repeat the question.
7 Just I want to make sure.

8 Q. In Pierce, when drone system
9 600 is a drone, is the object tracking
10 module 615 on board the drone?

11 A. 615 says a bus 615. If you go
12 in the middle of Paragraph 42, it says
13 includes a processor, memory, an interface,
14 and a bus 615. A PCI bus or other
15 interconnection fabric.

16 Q. Let's go to Figure 6.

17 A. Yes.

18 Q. You see bus 615 there?

19 A. That's correct.

20 Q. And you see object tracking
21 module 615 there?

22 A. Yes.

1 Q. So my question is about the
2 object tracking module.

3 You understand that?

4 A. Yeah. But yeah. But you are
5 referring to the 615 tracking module or the
6 615 bus?

7 Q. The tracking module.

8 A. This may be a typo because
9 assigns the same numbers.

10 Q. Yes.

11 A. I see them both with the same
12 number.

13 Q. So my question is when drone
14 system 600 in Pierce is a drone, is the
15 object tracking module on board the drone?

16 A. Not based on the description of
17 the streaming server.

18 Q. What about based just on
19 Figure 6?

20 A. Figure 6 is just blocks. They
21 don't say any -- any placement of the boxes.

22 Q. Figure 6 shows that system 600

1 includes the object tracking module?

2 A. Are you referring to the 615?

3 Q. I'm referring to the object
4 tracking module that's shown on Figure 6.

5 A. Let me -- let me go back to
6 the -- my declaration. Just give me one
7 minute.

8 I'm going back to my
9 Paragraph 199 that Pierce does not disclose
10 anywhere that object detection by neural
11 network is performed on-board a drone.
12 Pierce does not suggest such an
13 implementation because it has all these
14 disclosures, streaming servers, the interface
15 611 who all of them point to processing
16 that's outside the drone. Plus the addition
17 of all these components make the system not
18 implementable. Like, for example, how are
19 you going to implement a laser tracking and
20 all these other components on a system
21 that -- where the power is limited,
22 especially when we're talking about 10-plus

1 years ago?

2 So that's why I believe Pierce
3 hasn't thought -- there is not description
4 there to justify that all the stuff is on the
5 drone.

6 Q. So maybe we can close the loop
7 on this. I just want to make sure I clearly
8 understand your testimony.

9 Pierce describes that drone
10 system 600 may include object tracking
11 module 615, correct?

12 MS. L'ESPERANCE: Objection;
13 mischaracterizes. Asks -- asked and
14 answered.

15 A. Yes, it has a high-level
16 description of object detection by neural
17 network, and my objection, my strong
18 objection to this is actually that Pierce,
19 through the figures and through the spec,
20 does not state that object detection by
21 neural networks perform on board drone.

22

1 (BY MR. WALTERS)

2 Q. Okay. Paragraph 45 states that
3 drone system 600 may further include object
4 tracking module 615?

5 A. It uses the words but to me
6 they don't -- they're not meaningful.

7 Q. Okay. And Paragraph 42 of
8 Pierce states that in various embodiments
9 drone system 600 may be a drone?

10 A. It uses the word but, again, it
11 uses other words that make the whole thing,
12 as I stated in my paragraphs 199.

13 Q. In light of the words used by
14 Pierce, it's your testimony that Pierce does
15 not describe that object tracking module 615
16 may be on board the drone?

17 A. My opinion, I present the
18 initial disclosures and then I'm saying
19 Paragraph 199: "Pierce does not state that
20 'object detection by a neural network' is
21 performed on-board the drone. Pierce also
22 does not suggest such an implementation, and

1 instead, discloses a drone system in which
2 the neural network based object detection is
3 performed by a 'streaming server' that is
4 separate from the drone."

5 And I present from his
6 disclosures where I base my opinion.

7 Q. Can you turn to paragraph --
8 I'm sorry, I didn't mean to interrupt you.

9 A. Sorry. In Paragraph 200 I'm
10 saying if we look at Figure 5, Pierce
11 discloses 'a neural network system 500' that
12 'includes a processor, a memory, an
13 interface,' and that 'operates a streaming
14 server.'"

15 This is Paragraph 38 and
16 Figure 5. Thus, I'm saying as a result "the
17 embodiments of the drone system 600 that
18 perform neural network based object detection
19 and operate as a streaming server, include a
20 server (such as the neural network system),
21 that is a 'separate component' from the drone
22 and that implements a neural network."

1 And then I'm saying: "At the
2 time of the filing of Pierce and the '452
3 application a POSITA would have known that a
4 'streaming server' communicates with other
5 entities via a network, such as the
6 Internet."

7 In 202, I say: "Consistent
8 with the operation of the drone system as a
9 'streaming server' which involves
10 communication via network, Pierce discloses
11 that the drone system includes 'an
12 interface.'"

13 And this interface include
14 Ethernet interfaces, frame relay interfaces,
15 cable interfaces, DSL interfaces, according
16 to Paragraphs 39 and 43. All these examples
17 are wired interfaces that only a separate
18 server, and not a processor on board a UAV
19 can support.

20 And then in 203 I say: "Pierce
21 claim 11 recites a 'system' having 'a drone'
22 and 'one or more processors' and 'memory'

1 that stores instructions."

2 "Claim 11 does not recite the
3 processors and the memory as part of the
4 drone."

5 So I'm saying as a result in
6 light of Pierce's disclosure a POSITA would
7 have understood that a drone system 600 is
8 not provided and cannot be provided at the
9 UAV.

10 Q. You're just reading directly
11 from your declaration; is that right?

12 A. Yeah, just to be sure that I
13 have -- that I give an accurate description
14 of my opinion.

15 Q. Okay. Let's turn to
16 Paragraph 213 of your declaration.

17 A. Yes.

18 Q. Paragraph 213 discusses
19 proposed substitute claim 36 based on the
20 previous page.

21 Do you see that?

22 A. Let me see. I think this is a

1 typo. Let me -- let me just make sure.

2 I think there's a typo. I'm
3 saying as discussed above for proposed
4 substitute claim -- oh, no, let me -- let me
5 read it just to make sure.

6 Q. Sure.

7 A. Yeah. I think that's a typo.
8 And I apologize for this.

9 I need to say I discuss above a
10 proposed substitute claim 21, not 11.

11 Q. Okay. Do you see the claim 36
12 limitation that is included at Paragraph 212
13 on the previous page?

14 A. Yes.

15 Q. And this limitation is one that
16 we discussed earlier and it includes: "The
17 limitation comprises incrementally predicting
18 the location of the target in the image."

19 Do you see that?

20 A. That's correct.

21 Q. And in Paragraph 213, you
22 discuss the Beard reference?

1 A. Yes.

2 Q. You state: "Beard describes
3 predictively analyzing the future position or
4 future direction of a target skier but uses
5 data received from the skier smartphone to
6 this end."

7 Do you see that?

8 A. That's correct.

9 Q. So my question is: Do you
10 believe Beard teaches incrementally
11 predicting the location, but it's not
12 relevant because it uses data received from a
13 smartphone?

14 MS. L'ESPERANCE: Objection;
15 form.

16 A. It goes back to the -- to the
17 core of the case that we're discussing a
18 drone that does everything on its own with
19 resources available, no control from outside.

20 So here, we have this -- if you
21 look, we have this smartphone, which is
22 outside the drone providing this information.

1 That's what I'm trying to capture here.

2 (BY MR. WALTERS)

3 Q. Okay. Is "incrementally
4 predicting the location" different from
5 "predictively analyzing the future position
6 of the target"?

7 A. I'm just using the terms from
8 its spec.

9 Q. Yes.

10 A. So analyzing, it may mean left
11 or right. It may not necessarily mean
12 predicting the location at 1.2 meters to my
13 left or at 102 pixels left or right.

14 So analysis, it may be that
15 Nikos is left to drone, but it doesn't say
16 the -- predicting the location.

17 So I may say my future position
18 is going to be the left of my current
19 location, but the important thing for the
20 drone in order to accurately move, we may
21 need to say, and we have to say, that this is
22 1.1 meters to the left or you need to move so

1 your camera has the target 50 pixels to the
2 right or to the left. Analysis is not
3 finding -- predicting the exact location of a
4 target.

5 Q. Okay. So it's your testimony
6 that predictively analyzing the future
7 position is not predicting the location?

8 A. As I mentioned, analysis may
9 mean a lot of different things. But given
10 the context of the particular disclosure
11 in -- in the particular reference in Pierce,
12 I believe that this is not meant -- what
13 we're saying here, predicting the location of
14 a target.

15 Q. Is it -- it sounds like it may
16 not be, and I'm -- I'm curious as to whether
17 it's your opinion that predictively analyzing
18 the future position may be incrementally
19 predicting the location?

20 MS. L'ESPERANCE: Objection;
21 asked and answered.

22 A. I will stick to what I say here

1 because --

2 (BY MR. WALTERS)

3 Q. That's not a question I've
4 asked before.

5 A. Yeah. But I want to go back to
6 my declaration, that: "Beard describes
7 'predictively analyzing the future position
8 of future direction...'"

9 So all this lead to me that
10 it's more left to right than actual
11 coordinates or exact number of pixels left
12 and right.

13 So that's why I believe that
14 this doesn't meet the disclosure of the
15 substitute claim.

16 (Discussion off the record.)

17 (BY MR. WALTERS)

18 Q. And in your declaration, your
19 opinion is based on the fact that in Beard it
20 uses data received from the skier smartphone
21 to this end?

22 A. It's one of the elements that I

1 consider. Because think about the following,
2 the system is not -- we don't know the exact
3 location of the phone with respect to the
4 drone.

5 If you look at the kinematics
6 and dynamics of the system, the configuration
7 that is shown in the Figure 3 is not solvable
8 in order to have the exact coordinates of the
9 pixels.

10 So that's why I believe that he
11 refers to where left and right the skier may
12 be.

13 Think of the following: If I
14 have the phone, and I have the phone in my
15 pocket or I have the phone in front of my
16 face, these are two different numbers.

17 How the system will know the
18 exact location of the phone with respect to
19 the drone in order to say move at this speed
20 or change your speed.

21 This is three-dimensional
22 tracking math.

1 MR. WALTERS: This a good time
2 for a break?

3 THE WITNESS: I'm fine with a
4 break.

5 MR. WALTERS: Ten minutes.

6 (Break from 11:21 a.m. to 11:33 a.m.)

7 (BY MR. WALTERS)

8 Q. Welcome back, Dr. Nikos.

9 I would like to turn to the
10 '711 patent, Exhibit 1001.

11 A. Just give me a minute.

12 Yes, I'm there.

13 Q. I would like to look at
14 Figure 2.

15 A. There are several Figure 2 --
16 sorry, let me see if it -- yeah. Yeah.

17 Q. Figure 2 shows a UAV 200,
18 correct?

19 A. Yes.

20 Q. And that UAV 200 includes a
21 radar system 202 on board the UAV?

22 A. Let me look at the description

1 just to make sure.

2 Bear with me just one minute.

3 That's right, yeah. If we'll
4 go to the description, Column 5, Figure 2
5 describes basically the components.

6 Q. The radar system 202 includes
7 antennas 203?

8 A. That's correct.

9 Q. That's for receiving radar
10 signals?

11 A. That's correct.

12 Q. And those radar signals are
13 external to the UAV?

14 A. Yeah. It's -- for example, if
15 you move down, it says that they -- we have a
16 transmission signal.

17 And then these antennas, if you
18 go to the element 43: "The reflection signal
19 may be received by one or more antenna."

20 So we have a transmission, and
21 they reflect the signal can be received by
22 some of these antennas.

1 "In some embodiments, the
2 reflection signal is received by a subset of
3 the one or more antennas. In other
4 embodiments, the reflection signal is
5 received by all of the one or more antennas
6 203."

7 Q. And those signals received by
8 the antennas are external signals that the
9 antennas are receiving, correct?

10 MS. L'ESPERANCE: Objection;
11 scope.

12 A. The embodiment that mentions in
13 the same column is Line 50, it says that
14 these are coming from a reflecting object.

15 (BY MR. WALTERS)

16 Q. Is the reflecting object the
17 UAV?

18 MS. L'ESPERANCE: Objection;
19 scope.

20 A. Let me -- it may be a different
21 UAV.

22

1 (BY MR. WALTERS)

2 Q. The antennas 203 are not
3 receiving internal signals from UAV 200,
4 correct, they're receiving external signals?

5 A. Yeah. And it describes, for
6 example -- in the example shown -- this is
7 Line 33: "UAV 200 comprises a radar system,
8 one or more" --

9 (Discussion off the record.)

10 A. If we go Line 23 in the same
11 column, in the example shown: "UAV 200
12 comprises a radar system, one or more IMUs
13 206, and interdiction system 207. UAV 200
14 may include one or more other systems and/or
15 components that are not shown. Propellers,
16 et cetera."

17 It continues to say: "The
18 radar system is comprised of one or more
19 antennas."

20 And then it says that: "In
21 some embodiments, the one or more antennas
22 are configured to operate in a frequency

1 range of 79 megahertz, 1 gigahertz. In
2 response to the excitation signal, the one or
3 more antennas are configured to transmit the
4 signal. The transmission signal may
5 propagate through space. The transmission
6 signal may reflect off one or more objects.
7 This may be objects in the environment,
8 another UAV, or a target UAV. The reflection
9 signal may be received by the one or more
10 antennas 203. In some embodiments, the
11 reflection signal is received by a subset of
12 the one or more antennas 203 and the
13 reflecting object, the medium in which the
14 signal is transmitted, the environment, and
15 the material of the reflecting objects, etc.

16 "The one or more processors are
17 configured to receive the reflection signal
18 for one or more antennas."

19 (BY MR. WALTERS)

20 Q. Can you turn to Column 25 of
21 the '711 patent.

22 A. That's -- let me go there.

1 Yes.

2 Q. The very bottom of that column
3 at Line 66 the patent discusses a multimodal
4 sensor empowered awareness system.

5 Do you see that?

6 A. Yes.

7 Q. On Column 26, Line 5, the next
8 paragraph, it states: "The system employs a
9 main tracking sensor."

10 Do you see that?

11 A. Yes.

12 Q. And then it states that
13 proximal sensors complement the main tracking
14 sensor?

15 A. Yes.

16 Q. And then in that same paragraph
17 it states: "The sensors may include sound,
18 RF, LIDAR, RADAR, GPS"?

19 A. That's correct.

20 Q. In the next paragraph, the
21 patent discusses drone operation logic 2000.

22 Do you see that?

1 A. Yes.

2 Q. And that drone operation logic
3 2000 may be used to implement a system
4 operating a multimodal sensor empowered
5 awareness engine that we just discussed?

6 A. Yes. Let me -- I think --

7 Q. You see that?

8 A. Yes. The spec here goes and
9 says how the system can be used in a larger
10 environment.

11 (Discussion off the record.)

12 A. So the spec here has different
13 embodiments, how, for example, the
14 image-based tracking, because, again, the
15 information doesn't come for the -- for the
16 whole set of substitute claims and the
17 claim 12 we are talking about images.

18 They don't come -- the position
19 information doesn't from -- the input is
20 images. It's not position data that come,
21 for example, from a phone or something like
22 that.

1 So here, it just discusses
2 different embodiments where the main unit can
3 be enhanced and a variety of other sensors.

4 (BY MR. WALTERS)

5 Q. Those sensors are receiving
6 external signals?

7 MS. L'ESPERANCE: Objection;
8 scope. Asked and answered.

9 A. We have two types of sensors
10 generally: either sensors which are
11 monitoring the system or system -- or sensors
12 that monitor the environment.

13 (BY MR. WALTERS)

14 Q. The sensors described in
15 Column 26 with respect to the multimodal
16 sensor empowered awareness system for the
17 drone described in Figure 20 include RF,
18 LIDAR, RADAR, and GPS sensors, correct?

19 A. As it says, may include, so
20 it's a -- it's an embodiment.

21 Q. And those sensors are receiving
22 external signals?

1 MS. L'ESPERANCE: Objection;

2 scope. Asked and answered.

3 A. That's -- that's -- that's my
4 understanding.

5 (BY MR. WALTERS)

6 Q. Did you review the patent owner
7 preliminary response in this proceeding?

8 A. Yes. But let me -- it might
9 have been not -- might have been in the first
10 phase in the middle of February. So do you
11 have -- do you recall the exhibit?

12 Q. It's one of the briefs filed.
13 It's not an exhibit.

14 A. I see. Let me...

15 Q. It's Paper No. 11.

16 A. Yeah. Let me open it.

17 I have it open.

18 Q. I'd like to turn to Page 30.

19 A. Bear with me.

20 With the number 30 or in the
21 PDF Document 30?

22 Q. It has the number 30 on the

1 page.

2 A. Yes.

3 Q. About two thirds the way down
4 on that page, there's a sentence that states:
5 "Also per claim 12, the plain, ordinary, and
6 customary meaning or autonomously navigating
7 is performing navigation by the reference UAV
8 itself."

9 Do you see that?

10 A. Let me -- let me see.

11 I see that.

12 Q. Can you go to the next page.

13 The last sentence of the
14 middle -- middle paragraph states: "Thus, a
15 POSITA would have understood that
16 autonomously navigating the reference UAV
17 means making flight decisions by a component
18 of the reference UAV itself so as to direct
19 the reference UAV towards a geographic
20 location received by the reference UAV."

21 Do you see that?

22 A. Yes.

1 And I have a whole part in my
2 declaration that addresses this issue.

3 Q. Sure. Let's look at that.

4 A. Let me go to my declaration.
5 For example, Paragraph 86.

6 Q. In Paragraph 87 you state that
7 it's your opinion that the meaning of
8 autonomously navigating is making navigation
9 decisions by itself without outside control.

10 You see that?

11 A. Yes. "... meaning of
12 'autonomously navigating' is making this
13 navigation itself by itself without outside
14 control."

15 Q. Why does patent owner set forth
16 three separate constructions for autonomously
17 navigating in this proceeding?

18 MS. L'ESPERANCE: Objection;
19 form.

20 A. I don't see this as three
21 different structures.

22 (BY MR. WALTERS)

1 Q. Are there any differences in
2 these constructions?

3 A. I don't see -- I mean, I would
4 like to stick to my opinion because I was
5 asked to look at this and I offer my opinion.

6 So I was not included in the --
7 in the -- so I think, as we discussed
8 yesterday, I'm trying to pick a system and
9 also with a spec, whoever is describing the
10 spec.

11 So I would like -- I would like
12 to stick to this definition. And this is
13 where I base all my analysis for claim 12.

14 Q. Sure. I understand that. I'm
15 interested in your opinion on the differences
16 in these constructions.

17 A. I don't see the differences
18 but, again, we started -- I started -- I was
19 given the task and I was not tasked to view
20 other construction. I was asked to basically
21 provide my opinion.

22 (Discussion off the record.)

1 A. I was asked to provide my
2 opinion.

3 (BY MR. WALTERS)

4 Q. You agree that the
5 constructions are different from each other?

6 MS. L'ESPERANCE: Objection;
7 mischaracterizes.

8 A. I was asked to look at this
9 fresh and this is what I am doing here.

10 (BY MR. WALTERS)

11 Q. Sir, and so that's not my
12 question.

13 My question is: Do you agree
14 that the constructions are different from
15 each other?

16 MS. L'ESPERANCE: Objection;
17 form.

18 A. I didn't spend time looking at
19 this. I tried to offer my independent
20 opinion.

21 (BY MR. WALTERS)

22 Q. Your footnote says that you

1 note that the patent owner preliminary
2 response presented not the same meaning.

3 So you did look at those other
4 constructions, correct?

5 A. It's -- the way I see it is I
6 tried to add more mapping of my knowledge as
7 a POSITA and what is the ordinary meaning.

8 So they are similar. Maybe
9 there is words missing and -- or something,
10 but I tried to focus the most complete
11 version of what I believe is the plain,
12 ordinary, and customary meaning of autonomous
13 navigating is.

14 Q. So I understand your opinion is
15 that they're similar constructions, and my
16 question is: In your view as a POSITA, how
17 are they different?

18 (Discussion off the record.)

19 A. I think I used different words,
20 but they have a similar meaning.

21 (BY MR. WALTERS)

22 Q. Not the same meaning?

1 A. I think at the end of the day,
2 this is important thing. And I have been
3 consistent throughout my discussions. To me,
4 autonomous navigation means that performing
5 navigation by the reference UAV by itself,
6 without external intervention.

7 Q. What is a navigation decision?

8 A. In general, can you point me --
9 I mean, as part of the spec, as part of the
10 substitute claims, or the original claim. In
11 this case, the claim 12.

12 Q. As used in this proceeding,
13 what is a navigation decision?

14 MS. L'ESPERANCE: Objection;
15 form.

16 A. So let's go to claim 12.
17 So bear with me for one minute.
18 So I'm reading from the patent,
19 Exhibit 101 [verbatim], claim 12.

20 "The method of claim 1 further
21 comprising: receiving a geographical location
22 associated with the target detected at least

1 in part using a ground-based sensor;
2 autonomously navigating the reference aerial
3 vehicle towards the received geographical
4 location; and determining to allow
5 image-based navigation."

6 And if you go to my
7 declaration, 86 -- Paragraph 86: "I note
8 further that claim 12 recites 'autonomously
9 navigating the aerial -- the reference aerial
10 vehicle.' The '711 patent discloses a UAV
11 301 having a CPU 'configured to control the
12 overall operation of UAV 301.'"

13 This is Column 9, 25-27 rows.

14 "The 'CPU may be configured to
15 perform one or more flight decisions for the
16 UAV' by providing 'one or more flight
17 commands' that 'may include a specified speed
18 for the UAV, a specified flight height for
19 the UAV, a particular flight path for the
20 UAV, et cetera.'"

21 This is Column 9: 38-43. And
22 Column 9: 49-51.

1 "In some embodiments, the CPU
2 is configured to autonomously fly UAV 301."

3 This is Column 16: 49-55.

4 "... (when a target is detected,
5 a 'flight direction and/or speed of
6 interceptor of aerial vehicle are
7 automatically and autonomously adjusted'),
8 Figures 3 and 4."

9 (BY MR. WALTERS)

10 Q. So I ask you what a navigation
11 decision was, and you quoted claim 12, and
12 then you read directly from your declaration.
13 Correct?

14 A. That's correct.

15 Q. Can you elaborate beyond
16 reading directly from your declaration and
17 quoting claim 12 on what a navigation
18 decision is?

19 A. I will go back to the claim
20 because I think it's autonomous navigating.

21 The subject of the navigation,
22 where moving the reference aerial vehicle

1 autonomously towards the received
2 geographical location. In determining this
3 navigation needs to allow image-based
4 navigation.

5 In other words, if my
6 navigation is not fast enough, I may lose the
7 target. So that's why we had this discussion
8 about all these aspects earlier.

9 So autonomously navigating.
10 The subject of the navigation is the aerial
11 reference vehicle towards a particular
12 location and determining to allow image-based
13 navigation.

14 So there is the phase where we
15 tried to move autonomously the drone, the
16 aerial system, within the proximity -- visual
17 proximity of the target drone in order to
18 have the image-based navigation that is
19 discussed in claim 1.

20 Q. Your construction of
21 autonomously navigating is making navigation
22 decisions by itself without outside control,

1 correct?

2 A. That's correct.

3 Q. How does someone know if
4 something is a navigation decision?

5 MS. L'ESPERANCE: Objection;
6 form.

7 A. Can you elaborate? Because
8 there are many different scenarios.

9 (BY MR. WALTERS)

10 Q. These are your words, making
11 navigation decisions.

12 A. But I said that make navigation
13 decisions. In the -- in the case of 12,
14 there is the element that we need to
15 determine to allow image-based navigation.

16 Q. You understand that making
17 navigation decisions is part of your
18 construction of autonomously navigating,
19 correct?

20 A. That's true.

21 Q. And the reason for that -- the
22 reason you're construing the term is to allow

1 a fact finder to apply the construction to
2 either an accused system or a prior art
3 reference.

4 You understand that?

5 A. That's true.

6 MS. L'ESPERANCE: Objection;
7 form. Argumentative.

8 (BY MR. WALTERS)

9 Q. So how can a fact finder apply
10 the term "making navigation decisions" to an
11 accused system or a prior reference if they
12 don't know what "making navigation decisions"
13 means?

14 A. We use -- I'm going back to my
15 statement here that: "Therefore, it's my
16 opinion that in light of the specification of
17 the '711 patent, the plain and
18 ordinary/customary meaning of 'autonomously
19 navigating' is making navigate [verbatim]
20 decisions."

21 I use the plain and
22 ordinary/customary meaning.

1 Q. What is a navigation decision?

2 MS. L'ESPERANCE: Objection;
3 asked and answered.

4 A. Where and how to move.

5 (BY MR. WALTERS)

6 Q. What would entail making a
7 navigation decision?

8 MS. L'ESPERANCE: Objection;
9 form.

10 A. I'm going to go back.

11 So Paragraph 86 we have a UAV
12 301 that's having a CPU, which is configured
13 to control the overall operation of the UAV.
14 The CPU may be configured to perform based on
15 the spec one or more flight decisions for the
16 UAV.

17 So we need the CPU and the CPU.

18 Also, it says: "...by
19 providing 'one or more flight commands' that
20 'may include the specified speed for the UAV,
21 a specified flight height for the UAV, and a
22 particular flight path for the UAV.'"

1 And: "(...in some
2 'embodiments, the CPU is configured to
3 autonomously fly the UAV 301')." "

4 And then to put more context
5 and to answer your question: "...a flight
6 direction or speed of interceptor aerial
7 vehicle are automatically and autonomously
8 adjusted.'" "

9 (BY MR. WALTERS)

10 Q. Is the CPU providing commands
11 the same as the CPU making flight decisions
12 by itself?

13 A. I think what matters is
14 basically they are on the same -- I will say
15 that the way I understand it, in the spec is
16 the same unit, but both of them are contained
17 with this -- within this aerial vehicle
18 UAV 301.

19 Q. So I asked you a question, you
20 answered on what you think matters.

21 You understand that?

22 A. I'm not sure. You're referring

1 to what?

2 Q. Sure. Let me ask the question
3 again.

4 A. Yeah.

5 Q. Is the CPU providing commands
6 the same as the CPU making flight decisions
7 by itself?

8 A. Based on the spec, I will say
9 yes.

10 Q. Let's look at claim 12.

11 A. You want me to go to the
12 patent?

13 Q. Yes. Thank you.

14 A. Give me a minute.

15 Yes.

16 Q. Claim 12 is a method claim?

17 A. Yes.

18 Q. It includes a number of steps?

19 A. That's true.

20 Q. The first step is: "Receiving
21 a geographical location associated with a
22 target detected at least in part using a

1 ground-based sensor"?

2 A. That's true.

3 Q. Does claim 12 specify a
4 particular component that performs that
5 limitation?

6 A. Can you repeat the question,
7 please.

8 Q. Does claim 12 specify a
9 particular component that performs that
10 limitation?

11 A. Since we incorporate the
12 claim 1, the claim 1 states a method of
13 performing a flight control operation of a
14 reference aerial vehicle.

15 So since it says "further
16 comprising," first to this particular
17 reference aerial vehicle receiving a
18 geographical location.

19 Q. I don't know if -- are you done
20 with your answer?

21 MS. L'ESPERANCE: Objection;
22 form.

1 A. Can you repeat your question.

2 Q. Sure.

3 Does claim 12 specify a
4 particular component that performs the step
5 receiving a geographical location associated
6 with a target detected at least in part using
7 a ground-based sensor?

8 A. Since we have claim 1, further
9 comprising, claim 1 says: "A method of
10 performing a flight control operation of a
11 reference aerial vehicle, comprising."

12 So since we have "comprising"
13 and "comprising," their reference aerial
14 vehicle is going to receive this geographic
15 location.

16 Q. Okay. It's your testimony that
17 claim 12 requires that a reference aerial
18 vehicle receives a geographical location
19 associated with a target detected at least in
20 part using a ground-based sensor?

21 A. This is what the claim states.

22 Q. Okay. Does claim 12 -- well,

1 strike that.

2 The second step in claim 12 is:
3 "Autonomously navigating the reference aerial
4 vehicle towards the received geographical
5 location."

6 Do you see that?

7 A. That's correct.

8 Q. Does claim 12 specify a
9 particular component that performs that step?

10 A. I think, again, since we have
11 an image sensor mounted on the reference
12 aerial vehicle and we have detecting the
13 target in the image identifying, so we're
14 talking about an image-based system.

15 Q. Is it your opinion that
16 claim 12 requires a reference aerial vehicle
17 recited in claim 1 to perform the step of
18 autonomously navigating the reference aerial
19 vehicle towards the received geographical
20 location?

21 A. Can you repeat the question.

22 Q. Is it your opinion that

1 claim 12 requires the reference aerial
2 vehicle recited in the preamble of claim 1 to
3 perform the step of autonomously navigating
4 the reference aerial vehicle towards the
5 geographical location?

6 A. But isn't -- I mean, this is
7 Step 2 of claim 12.

8 Q. Correct.

9 A. And it says "autonomously
10 navigating the reference aerial vehicle."
11 It's very specific.

12 Q. I'm just interested in your
13 answer.

14 A. I'm just stating what the claim
15 says. And the plain, ordinary meaning of.

16 Q. Is what?

17 A. Autonomously navigating the
18 reference aerial vehicle towards the -- the
19 received geographical location.

20 Q. Does claim 12 require that the
21 reference aerial vehicle perform that step?

22 MS. L'ESPERANCE: Objection;

1 asked and answered.

2 A. Yes.

3 (BY MR. WALTERS)

4 Q. Okay. Does claim 12 specify a
5 particular component that performs the step
6 determining to allow image-based navigation?

7 A. I think it refers to the aerial
8 vehicle. It discloses -- I mean, we are
9 talking about the single aerial vehicle that
10 we want to position in a fashion through
11 these steps in order to be able to do
12 image-based navigation.

13 In other words, we want to
14 locate to the target drone in order to do
15 within the boundaries of the aerial vehicle
16 to rejoin [phonetic] resources the
17 image-based navigation.

18 Q. Is it your opinion that
19 claim 12 requires that the reference aerial
20 vehicle recited in the preamble of claim 1 to
21 perform the step determining to allow
22 image-based navigation in claim 12?

1 A. Yes.

2 Q. Can you look at Column 4 of the
3 patent, Exhibit 1001.

4 A. Column 4? I am there.

5 Q. Specifically at Line 34.

6 Actually, let's go to
7 Column 15.

8 A. Sure. Yes.

9 Q. At Line 59.

10 A. Column 15? Can you tell me
11 again.

12 Q. Sure. Line 59.

13 A. And Column 15?

14 Q. Yes.

15 A. Yes.

16 Q. There's a sentence there that
17 states: "The location of the target may be
18 updated and continually received as a new or
19 updated location of the target is
20 determined."

21 Do you see that?

22 A. I see that.

1 Q. So it's talking about receiving
2 a -- a new or updated location?

3 A. Yes, but this is in view of the
4 earlier column you took me.

5 Can you tell me the original
6 column?

7 Q. Column 4.

8 A. Column 4. It talks about
9 different embodiments but Column 4 I think
10 you told me to go to 15.

11 Q. Line 34.

12 A. No, initially you told me
13 Line 15; am I right?

14 Q. No.

15 A. Let me -- let me ask you
16 something about Column 4. It says the
17 detected location -- this is Line 14. "The
18 detecting location of target aerial vehicle
19 110 may be provided to interceptor aerial
20 vehicle 102 to allow it to automatically and
21 autonomously fly towards the direction of the
22 detected location."

1 So this is the Step 1 of
2 claim 12. This is the spec.

3 Q. Let's look at claim 12.

4 A. Sure. Yes.

5 Q. So we just talked about in
6 Column 15 where it states: "The location of
7 the target may be updated and continually
8 received as a new or updated location of the
9 target as determined."

10 First step of claim 12 is
11 receiving a geographical location associated
12 with the target?

13 A. Yeah. This is one embodiment.
14 The other embodiment is just we give the
15 location, we have autonomous navigation, and
16 then we have determined the determination --
17 basically we have the image-based navigation.

18 Q. Could -- could the receiving a
19 geographical location in claim 12 be an
20 updated or new location?

21 A. It's possible.

22 But the meaning I understand

1 here is what we discussed in Column 4. We
2 give the location, and I think that's the
3 novelty.

4 We give the location, the
5 system -- the aerial vehicle autonomously
6 navigates towards the received geographical
7 location. It comes close and then it engages
8 to this novel image-based navigation. In
9 other words, by using images it locks the
10 target.

11 Q. I'd like to go back to the
12 Laufer reference.

13 A. Yeah. Just give me a minute.
14 I think I have shut it down.

15 Can you remind me the exhibit
16 number?

17 Q. 1010.

18 A. Yes.

19 Q. Specifically at Paragraph 40.

20 A. Just give me one minute. I am
21 there.

22 Q. In Paragraph 40, Laufer states:

1 "The central controller 115 uses autopilot
2 command module 440 to general autopilot
3 aircraft commands 445."

4 You see that?

5 A. That's true.

6 Q. What's your understanding of
7 autopilot?

8 A. I have a whole set of
9 paragraphs in my declaration.

10 So I'm starting talking about
11 Laufer Paragraph 89. Let me go to
12 Paragraph 92.

13 "Laufer also states that the
14 central controller" -- please note the
15 central controller is on the ground -- "can
16 'determine the location at which the target
17 and the interceptor aircraft will intersect,'
18 the 'interception location.'"

19 Thereafter central controller
20 uses -- this is the paragraph you mentioned.
21 "Thus -- Paragraph 93 -- "in Laufer's system
22 navigation of the UAV, so that it may fly to

1 the interception location, is accomplished
2 under the control of the central controller.
3 Laufer's autopilot commands may not be
4 provided by a human, and may be instead be
5 generated by a computer, such as the one
6 provided in Laufer's autopilot command mode.
7 But those autopilot commands are generated by
8 the central controller."

9 And I want to emphasize this,
10 and not by the UAV. "Thus, the Laufer UAV
11 does not navigate itself. Accordingly,
12 Laufer does not teach or suggest
13 'autonomously navigating the reference aerial
14 vehicle,' as claim 12 recites."

15 And I want to add another
16 component here. I don't know if you have
17 ever seen an autopilot system. There is
18 always red buttons and human intervention.
19 You never fly a jet with autopilot alone
20 because there is no way for adjustments.

21 So the human intervention --
22 and, again, I recall we don't want to have

1 outside intervention -- is necessary for the
2 autopilot to work.

3 Autopilot is not what we
4 discussed as autonomously navigating.

5 Q. What is autopilot?

6 MS. L'ESPERANCE: Objection;
7 asked and answered.

8 A. An autopilot may control, for
9 example, the roll component of a plane with
10 having red buttons and alerts if something
11 goes wrong or some degrees of freedom of the
12 aerial vehicle.

13 (BY MR. WALTERS)

14 Q. Is it your opinion that when
15 Laufer is discussing autopiloting its UAV,
16 there's a human involved?

17 A. It uses the term "autopilot."
18 I mean, this is -- this is ordinary meaning
19 of autopilot.

20 Q. I think the answer to my
21 question is "yes" based on your response, but
22 I'm not clear.

1 So my --

2 A. Can you repeat -- can you
3 repeat.

4 Q. Sure. Sure.

5 Is it your opinion that when
6 Laufer is discussing autopilot with respect
7 to its UAV, there is a human involved?

8 A. It's a hypothetical, which it
9 has serious repercussions. I mean, I want to
10 remind the accident in the Reagan airport.

11 If someone was supervising the
12 autopilot, maybe the collision could have
13 been averted. I'm not saying that an
14 autopilot was used. But generally when we
15 have autopilot, first of all -- and this case
16 is outside the body of the aerial vehicle.

17 Second, the decisions are made
18 outside the body.

19 And the third, you may have
20 fewer degrees than the complete system
21 controlled.

22 And the fourth is -- I think

1 the common practice is actually you have both
2 pilots, ordinary motor vehicle operators,
3 supervising.

4 That's why there are all these
5 red alarms in the plane cockpit.

6 Q. Do you understand for -- strike
7 that.

8 Do you understand that there is
9 a human involved in autopiloting Laufer's UAV
10 when Laufer refers to autopilot commands?

11 A. I'm just stating how the POSITA
12 will understand by the -- by looking at the
13 term "autopilot."

14 Q. And your answer is that a human
15 would be involved?

16 A. A human will ideally be
17 involved.

18 Q. Okay. Would it surprise you
19 for a definition of "autopilot" to be a
20 device that keeps aircraft, spacecraft, and
21 ships moving in a particular direction
22 without human involvement?

1 A. Do you refer to the past? To
2 the current? To that time? Because we have
3 to put it in 2015.

4 Q. Current.

5 A. Current is a loaded topic. I
6 mean, and we need to look at the context.

7 Q. Is changing speed in response
8 to a speed command a navigation decision?

9 A. Yes.

10 Q. Your definition of autonomously
11 navigating includes without outside control?

12 A. That's correct.

13 Q. What is outside control?

14 A. Anything that comes with
15 exception of -- for example, of the
16 initialization phase or catastrophic failure,
17 anything that comes from outside the vehicle.

18 (Discussion off the record.)

19 (BY MR. WALTERS)

20 Q. Radar signals would come from
21 outside the vehicle?

22 MS. L'ESPERANCE: Objection;

1 scope.

2 A. Yeah. There are some
3 embodiments in -- there are different
4 scenarios. Some of them are mentioned in the
5 patent that may involve other external
6 signals.

7 (BY MR. WALTERS)

8 Q. Is there a difference between
9 making navigation decisions and performing
10 flight decisions?

11 A. Can you repeat the question.

12 Q. Is there a difference between
13 making navigation decisions and performing
14 flight decisions?

15 MS. L'ESPERANCE: Objection;
16 asked and answered.

17 A. These terms can be used
18 interchangeably, but somehow we need to
19 implement them within the means of the
20 particular aerial vehicle.

21 (BY MR. WALTERS)

22 Q. What do you mean by that?

1 A. So if you look at the 12, you
2 make -- let me -- let me go -- let me go to
3 my declaration.

4 So autonomously navigating is
5 making a navigation decision by itself
6 without outside control.

7 So we need to execute these
8 decisions in order to go towards -- and this
9 is the part that we say determining how we
10 can get -- this is the third -- let me -- the
11 third part of the claim 12.

12 "...autonomously navigating the
13 reference aerial vehicle towards the received
14 geographical location and determining to
15 allow image-based navigation."

16 In other words we need to
17 execute the commands in order to be ready and
18 engaged in order to do -- and engaging the
19 target in to order to do the imaged-based
20 navigation.

21 Q. Is changing pitch in response
22 to a pitch command a navigation decision?

1 A. Can you repeat, please.

2 Q. Is changing pitch in response
3 to a pitch command a navigation decision?

4 A. It's a possibility. It's the
5 execution of the navigation command.

6 Q. Can you look at your
7 declaration at Paragraph 87.

8 A. Sure.

9 Yes, I'm there.

10 Q. Your declaration cites
11 Exhibit 2012.

12 Do you see that?

13 A. Yes.

14 Q. Can you pull up Exhibit 2012.

15 A. Bear with me.

16 It's the Cambridge Dictionary?

17 Q. Yes.

18 A. Yes.

19 Q. In Paragraph 87, you cite to
20 this dictionary definition of "autonomous."
21 And you state that it is: "...independent
22 and having the power to make your own

1 decisions"?

2 A. That's correct.

3 Q. At the bottom of Exhibit 2012,
4 there's another definition provided for
5 "autonomous" that is: "Able to operate
6 without being controlled directly by humans."

7 Do you see that?

8 A. Yes.

9 Q. And the context for that
10 definition is an autonomous vehicle?

11 A. Yes.

12 Q. Would that be an appropriate
13 definition for a drone?

14 A. So an autonomous vehicle and an
15 autonomous drone have some significant
16 differences.

17 So the reason why I pick this
18 one, autonomous vehicle has constraints, it's
19 moving on the ground. It doesn't involve --
20 the problem of navigation is simpler. It has
21 different characteristics.

22 So I think -- based on the

1 spec, I think the "independent and having the
2 power to make your own decision," it's --
3 it's something that represents what is in the
4 spec.

5 (Discussion off the record.)

6 A. I believe the independent and
7 having the power to make your own decision
8 based on the spec, it's a better
9 representation of what is described in the
10 '711.

11 (BY MR. WALTERS)

12 Q. Is a drone an autonomous
13 vehicle?

14 A. We have different types of
15 drones. Are you referring to a specific type
16 or something?

17 Q. An aerial vehicle.

18 Let me ask a different
19 question.

20 Is an aerial vehicle an
21 autonomous vehicle?

22 A. There all sorts of aerial

1 vehicles. Wired, not wired, autonomous,
2 semiautonomous, they require human
3 supervision. So small, big. I mean, there
4 are different categories.

5 Q. Are there aerial vehicles that
6 you would categorize as autonomous vehicles?

7 A. I think the Airspace system,
8 which is currently in use, is an autonomous
9 vehicle, aerial vehicle.

10 Q. Did you say the Airspace
11 system?

12 A. The Airspace.

13 MR. WALTERS: Would it be a
14 good time for a break?

15 THE WITNESS: It's fine with
16 me.

17 MR. WALTERS: Let's go off the
18 record.

19 (Break from 12:45 p.m. to 12:58 p.m.)

20 (BY MR. WALTERS)

21 Q. Welcome back, Dr. Nikos.

22 A. Thank you.

1 MR. WALTERS: I don't have
2 further questions at the time, so I'll
3 pass the witness.

4 MR. WADEKAR: Okay. So I just
5 have a few follow-up questions, and I
6 wanted to really start from the top,
7 but since we are at -- on this
8 Cambridge page reference, maybe I will
9 start there.

10 (Discussion off the record.)

11 EXAMINATION

12 BY MR. WADEKAR:

13 Q. So, Dr. Nikos, do you have
14 Exhibit one zero -- 2012 in front of you
15 still, the Cambridge Dictionary?

16 A. Just give me a minute, yes.

17 Q. Okay. So are you -- you
18 mentioned there are different types of drone
19 systems.

20 Are you aware of recreational
21 drones?

22 A. Yes.

1 Q. Can you describe what
2 recreational drones are generally?

3 A. We call them also hobby drones,
4 so they're used to take pictures from events,
5 from gatherings of people, from landscapes,
6 from traveling destinations.

7 Q. And how do those drones -- how
8 are those drones flown typically?

9 A. There is a joystick that
10 commands their movement.

11 Q. And who -- who controls the
12 joystick?

13 A. The owner. The operator.

14 Q. The operator and where -- where
15 is the operator?

16 A. Within some distance from the
17 drone.

18 Q. But the operator is not on the
19 drone?

20 A. No.

21 Q. Okay. So in terms of cars, are
22 you -- have you seen the toy cars that were

1 similarly operated by joystick?

2 (Discussion off the record.)

3 (BY MR. WADEKAR)

4 Q. So are you -- are you familiar
5 with toy cars that could similarly be
6 controlled by joysticks?

7 A. Yes.

8 Q. But are you aware of any
9 full-sized cars that are on roads that are
10 controlled by -- by joysticks by a human
11 outside of a car?

12 And -- yeah, no, I will let you
13 answer the question.

14 A. At least I am not aware.

15 Q. Okay. So this -- so now
16 referring to this Cambridge Dictionary --
17 give me one second. My computer froze up.

18 So it's okay now.

19 So when it is -- now I will
20 read the definition as it is seen here. It
21 says: "An autonomous machine or system is
22 able to operate without being controlled

1 directly by humans."

2 And that's what it then
3 mentions in the -- in the bullet "autonomous
4 vehicle."

5 So do you believe that -- so
6 what is your interpretation of this in the
7 context of an autonomous vehicle where it
8 says "without being controlled directly by
9 humans," what does that mean to you?

10 A. That we may have -- may have a
11 scenario which is different than the one that
12 we have here. An autonomous vehicle is a
13 different scenario than the drone because
14 duration.

15 Q. And how is it different?

16 A. It's different because you have
17 basically all the decision-making made on
18 both without external intervention. And
19 here, we have the --

20 Q. No, go ahead. Sorry. Sorry
21 for the interruption. Please complete your
22 answer.

1 A. So here, we have the word
2 "directly by humans," which is -- it -- it
3 doesn't correspond to the spec that we
4 discussed.

5 Q. Okay. Are you familiar with
6 "autonomous vehicles" as -- as that term may
7 be used in the context of cars that are
8 driven on roads?

9 A. As -- as ground --

10 Q. Yes.

11 A. -- ground vehicles?

12 Q. Yeah.

13 A. Yes.

14 Q. And so when -- when they are
15 autonomous, who makes the driving decisions?

16 A. It may be some degrees of
17 freedom are controlled autonomously. So, in
18 other words, by the vehicle resources. Some
19 degrees of freedom may control by human.

20 Either -- so in this case
21 indirectly, for example.

22 Q. Okay. So let's just focus on

1 the humans -- I'm sorry. Let me restate.

2 Let's focus on the decisions
3 that are not made by the humans.

4 In that case, who makes the
5 decisions?

6 A. The decisions can be made on
7 board or may be a preplan.

8 I mean, for example, in 2015,
9 you have had initial attempts for automated
10 parking. We have to make a distinction
11 between autonomous and automated.

12 Automated is a far less -- the
13 degree of autonomy is far less controlled.
14 It's far smaller.

15 Q. But let's just stay with
16 autonomous.

17 If it is -- if it is -- if it
18 is an autonomous car -- and I went to
19 distinguish between drones and -- or aerial
20 drones and road vehicles.

21 So let's just take a concrete
22 example of a car. If it is an autonomous car

1 and if it is -- if there is some decision
2 that it is made autonomously, where is that
3 decision made, and who makes that decision?

4 A. It can be made locally in the
5 car under the -- the supervision of a human.

6 So, for example, we have the
7 physical presence of a human next to the car
8 or close to the car. Here with the drones,
9 it's a completely different operation or
10 scenario because the human may be miles away.

11 Q. So but my question is
12 specifically limited just to cars.

13 And so let's -- let's take for
14 the purpose of this discussion, let's take
15 the human -- assume that there is no human in
16 the car, and there is some decision that is
17 made autonomously in the context of that
18 autonomous car.

19 Where is that decision made?

20 A. The decision is made in
21 implementations I'm aware outside the car and
22 then the car executes it by using the sensors

1 that it has it on board.

2 Q. So the decision is made on the
3 car or outside of the car?

4 A. Outside the car.

5 Q. Who -- who makes the decision?

6 A. The human.

7 Q. No, but I said -- I'm sorry.

8 Maybe you misunderstood my question. I'm
9 saying the human is not involved. Let us
10 state there is no human.

11 There is no human in the car
12 and the car is autonomously driving.

13 Now, we are not concerned
14 whether it will crash, whether it will
15 operate properly or not.

16 It is -- it is -- let's say
17 it's an experimental situation. There is no
18 human. The car is driving autonomously. It
19 is making an autonomous decision.

20 And I understand you described
21 earlier that there are degrees of autonomy
22 and that not all decisions can be made by a

1 car, but let's say some decisions are made by
2 the car. And this particular one, the
3 question I'm asking is made by the car.

4 A. Yeah.

5 Q. So -- but narrowing it down,
6 I'm creating a hypothetical that is very
7 limited. So there is no human. The decision
8 is made autonomously, and the car is -- and
9 the car -- as -- as I said, there is no human
10 in the car.

11 A. The processor -- the CPU's on
12 the car.

13 Q. The CPU's on the car. Okay.
14 All right.

15 Now, let's go back to your
16 declaration for a moment.

17 If you could, turn to
18 Paragraph 87, please.

19 A. Yes.

20 Q. In this you -- you mention that
21 it is your opinion -- and I'm simply going
22 to quote: It is -- you say: "It is my

1 opinion that in light of the specification of
2 the '711 patent the plain and
3 ordinary/customary meaning..."

4 And I won't repeat the rest of
5 the sentence.

6 So when you -- when you formed
7 this opinion, was this based on your
8 knowledge of the field?

9 A. I explained in Paragraph 86 --

10 Q. Yeah.

11 A. -- several disclosures in the
12 spec that lead to this.

13 Q. I understand. And you do say
14 "in light of the specification."

15 A. Yeah.

16 Q. I understand that, but -- but
17 in light of the specification, the -- did
18 you -- did you use your industry experience
19 or -- or knowledge in -- in coming up with
20 this definition?

21 A. Yes.

22 Q. And then -- but then you go on

1 and cite two references; is that correct?

2 A. Yes.

3 Q. So were these references
4 essential to your definition?

5 A. No, they were a secondary. In
6 fact, I wanted to make sure that I captured
7 at the period ten years ago what was there.

8 Q. Okay.

9 A. The definition.

10 Q. So staying on this topic of --
11 of autonomous, we discussed a reference and I
12 will read the correct number for you. Give
13 me one second. It is Laufer -- it is
14 Exhibit 1010.

15 A. Uh-huh.

16 Q. Do you recall this --

17 A. Yes.

18 Q. -- reference?

19 A. Let me bring it up. Just a
20 minute.

21 (Discussion off the record.)

22 MR. WADEKAR: Okay. We can go

1 off the record.

2 (Break from 1:12 p.m. to 1:16 p.m.)

3 (BY MR. WADEKAR)

4 Q. So before the short break, we
5 were -- I had just mentioned Laufer
6 Exhibit 1010.

7 A. Uh-huh.

8 Q. Do you have it?

9 A. Yes.

10 Q. And when we were discussing
11 Laufer, you -- you mentioned -- you -- you
12 provided an opinion about autopilot in
13 Laufer.

14 Do you recall that?

15 A. Yes.

16 Q. Do you recall that you said
17 that you would need a -- you would -- you
18 would understand Laufer's autopilot to mean
19 that it would be supervised by a human?

20 Do you recall that? I may not
21 be quoting you exactly but...

22 A. I said could have a human or

1 ideal it will have a human.

2 Q. Okay. So -- but so do you see
3 Laufer discussing a human anywhere in the
4 context of its autopilot command module?

5 A. No. But this is on top of my
6 opinion. I mean, Laufer, to me, is out for
7 the discussion of 12 because, as I mentioned
8 multiple times, that if you look at Figure 1
9 and the description of Figure 1, the
10 central 115 -- the system central controller
11 is on the ground. It's not on the vehicle.

12 And if you look at the
13 Paragraph 40 -- let me go there.

14 Paragraph 40 from Laufer says:
15 "Central controller 115 uses autopilot
16 command module 440 to generate autopilot
17 aircraft commands 445 based on interception
18 location and the interceptor aircraft
19 dynamics model. Central controller 115 uses
20 autopilot command module to solve for the set
21 of autopilot aircraft commands."

22 To me, that's the end.

1 Q. Okay.

2 A. It's outside the body.

3 Q. Okay. Now, let me go back to
4 the start of the deposition. And so in your
5 declaration, let us go to substitute
6 claim 21.

7 Let me know when you are there,
8 and I will tell you the -- the exact claim
9 element.

10 A. The preamble, Paragraph 107.

11 Q. Okay. So let us go to
12 Paragraph 115, which is on Page 56.

13 A. Yes.

14 Q. And it talks about on Page 56
15 in that table in the --

16 A. Wait. Wait. I -- I -- I have
17 the wrong number. Can you repeat the
18 paragraph.

19 Q. It is Paragraph 115.

20 A. 115. Okay. Sorry. Yes.

21 Q. So in that -- you see the --
22 the table below -- or in Paragraph 115?

1 A. Yes.

2 Q. You see in the column to the
3 left you see the words "a speed adjustment
4 factor"?

5 A. Yes.

6 Q. Can you describe how the speed
7 adjustment factor may be used?

8 A. Based on the specification or
9 in general?

10 Q. In general.

11 A. So we have the reference aerial
12 vehicle. We have the target with the
13 three-dimensional relative location with
14 respect to the reference aerial vehicle.

15 So we see the target going to
16 the right more and more.

17 Q. Uh-huh.

18 A. So we need to look at the
19 direction and the magnitude.

20 For example, is the angle, with
21 respect to the target, is increasing or the
22 set of angles are increasing and does it have

1 speed that it makes this distance longer and
2 longer.

3 So basically it needs to make
4 adjustments in order to compensate for these
5 essential components of the tracking.

6 Q. Okay. So -- so in the example
7 that you gave, let's say their target was
8 initially to the right, and it is now even
9 further to the right. So the angle changed.

10 And so based on that, are you
11 saying that its speed -- speed adjustment
12 factor could be computed?

13 A. Yes.

14 Q. And so what happened -- what
15 would happen if the target now moves even
16 further more to -- to the -- to the right, it
17 continues to move to the right?

18 A. If there is no adjustment,
19 you're going to lose the target.

20 Q. So -- so that -- so the speed
21 adjustment factor would be adjusted again?

22 A. As long as we look at the -- as

1 long as the image processing tell us that it
2 needs to be adjusted, it will be adjusted.

3 Q. So it is not necessary that the
4 speed adjustment factor is adjusted only
5 once; is that correct?

6 A. That's correct.

7 Q. Okay. So now -- now let us
8 change this hypothetical. Let us say that
9 the target kept on moving to the right, but
10 eventually now the direction is -- let us --
11 let's assume for this hypothetical the
12 direction is aligned, but now you see the
13 target either speeding up or -- so let me --
14 let me just stay with that. So you see the
15 target speeding up.

16 So now would the speed
17 adjustment factor be computed again?

18 A. We need to adjust based on the
19 magnitude of the -- of the --

20 Q. The speed?

21 A. -- of the speed.

22 Q. So then does that mean that

1 the -- there is not just one speed adjustment
2 factor, but it's a time series, that at
3 different times there will be different speed
4 adjustment factors?

5 A. It's a temporal variation.

6 Q. Okay. And so now when we go to
7 claim twenty -- 25, there is -- claim 25
8 begins on Page 62 in Paragraph 128.

9 And right at the bottom of
10 Page 62 it does say "a speed adjustment
11 factor based on the determined distance."

12 So is this a different
13 determination, so what once -- so on one
14 instance the speed adjustment factor in the
15 hypothetical we discussed was based on the --
16 the angles; is that correct?

17 A. Yes.

18 Q. And then it would be adjusted
19 again based on a changing angle, is that --

20 A. Yes.

21 Q. And once the -- the angles are
22 no longer changing, they could be changed

1 again, still further again based on speed; is
2 that correct?

3 A. Yes.

4 Q. Okay.

5 A. And if -- may I add, we may
6 have simultaneous changes, so we will have an
7 adjustment factor that compensates for both.

8 Q. Okay. And so then if there
9 are -- so -- so then there would be two
10 components for the adjustment factor, one
11 based on direction, other based on distance?

12 A. There are different
13 implementations.

14 Q. So there are two different
15 adjustment factors?

16 A. Yeah.

17 Q. Okay. But they -- but -- can
18 they -- if there are two different adjustment
19 factors, how are they represented further by
20 the system?

21 A. We used a linear superposition
22 principle, which is something that we use in

1 the tracking. This is tracking that involves
2 two highly known linear systems.

3 Q. Then would that involve vector
4 representation of these factors?

5 A. Potentially.

6 Q. Okay. So let's go to
7 Paragraph 146.

8 A. Let me go there.
9 146?

10 Q. Uh-huh.

11 A. Yes.

12 Q. And here, we are discussing
13 substitute claim -- proposed substitute
14 claim 31.

15 Do you see that?

16 A. Yes.

17 Q. Do you see the words "a speed
18 adjustment factor to smooth and limit a rate
19 of change"?

20 Do you see those words?

21 A. Yes.

22 Q. In -- what -- what -- what does

1 "smooth and limit a rate of change of speed"
2 mean in this context?

3 A. So you don't want to have to --
4 to smooth and limit a rate of change, so you
5 don't want to have continuous variations,
6 continuous rates of changes with magnitudes
7 that are going to shake the whole vehicle.
8 In other words, you want to have a smooth
9 trajectory.

10 Think -- think you are on a
11 plane that continuously vibrates, you don't
12 want to have something like this. You need
13 to have speed adjustments that are going to
14 have smooth trajectories for the rate of
15 change.

16 And, also, you want to have
17 limits. The same way you have a limit in
18 your car -- a velocity limit in your car, you
19 want to have something that does not go above
20 a certain rate of change because then you
21 have problems with structural integrity of
22 your vehicle.

1 Q. So then if I understand you
2 correctly -- but before that, let me go back
3 to the hypothetical that we were discussing
4 earlier.

5 So let us say you have a target
6 drone that is moving to the right and then it
7 moves further to the right, and you recall
8 that we -- we discussed that you would
9 compute a -- a speed adjustment factor based
10 on this direction change.

11 Is that -- you recall this?

12 A. Yes.

13 Q. Okay. So -- so in that
14 scenario, how would a smoothing and limiting
15 operation work?

16 A. So if suddenly these changes
17 are very dramatic, this will kick in because
18 you want to limit. And you want, for
19 example, take the previous one as a
20 measurement.

21 Don't forget that we have a
22 refresh rate continuously, so we need to make

1 sure that the vehicle moves forward, keeps
2 the target locked, but it's done in a way
3 that is smooth.

4 In other words, it doesn't have
5 this bouncy behavior.

6 And I think the spec that I
7 have cited here explains this.

8 Q. So it is a further adjustment
9 to the speed, then?

10 A. Yeah.

11 Q. Okay. So now do you recall the
12 discussion about robustness and refresh
13 rates -- you mentioned refresh rate just a
14 minute ago so --

15 A. Yeah.

16 Q. Okay. So are you familiar with
17 the -- with the concept of runtime complexity
18 of an algorithm?

19 A. Yes.

20 Q. Can you explain -- or briefly
21 explain what runtime complexity of an
22 algorithm means?

1 A. So let's suppose we have a
2 graph and we want to do -- to perform a
3 certain operation. We may have a quadratic
4 performance.

5 For example, we have Venn nodes
6 on the graph. We may have performance, which
7 is called $O(N^2)$.

8 Q. Uh-huh.

9 A. So this means that as the
10 number increases, the number of nodes, then
11 the performance goes -- it takes more time
12 along this quadratic scale.

13 Now, this is the upper bound
14 for this performance.

15 Q. Okay. And what if it is not
16 (N^2) ? What if it is just (N) ?

17 A. If it is (N) , it's linear, so
18 we're very happy.

19 Q. And can it be some other
20 function of (N) ?

21 A. Can be $(N) \log(N)$, which is
22 generally something that we target.

1 (N) is under very specific
2 conditions for these type of problems.

3 Q. Okay. So is it -- is it fair
4 to say, then, that the runtime complexity
5 will give you -- and you mentioned upper
6 bound -- it will give you an upper bound of
7 how -- how quickly the algorithm will
8 complete its task.

9 Is that -- is that fair to say?

10 A. Yes.

11 And the upper bound is very
12 time in the aerial time implementation of a
13 drone because it gives you -- you don't want
14 to have, let's say, an operation that changes
15 from 4 milliseconds to 10 milliseconds back
16 to 4 milliseconds, so we want to have the
17 same rate of change.

18 This is very important as part
19 of having real-time systems or embedded
20 systems.

21 Q. Okay. But let's -- let's go
22 with the example that you gave, the graph

1 that has N nodes.

2 A. Uh-huh.

3 Q. And so -- so we have
4 algorithm 1 that the runtime complexity is
5 the Big O that you mentioned, the $O(N)$.

6 A. Uh-huh.

7 Q. And we have a little n^2 that
8 has the runtime complexity $O(N^2)$?

9 So -- and I want to make it
10 really very simple, so let's say the --
11 the -- the graph has N nodes.

12 A. Uh-huh.

13 Q. And let's say -- so are you
14 saying that when you say it is $O(N)$ it will
15 need ten steps or ten operations?

16 A. So we need to visit at least
17 one, each one of the node. If we have (N^2) ,
18 we visit -- we need a hundred steps.

19 Q. Okay. So in -- so for
20 algorithm 1, it is 10 steps; for algorithm 2,
21 it is 100 steps?

22 A. Yes. In a very rough --

1 Q. And --

2 A. -- not automatical [verbatim].

3 Q. Understood. Understood.

4 And I want to keep this example
5 really simple, so let's assume that each step
6 takes only 1 millisecond?

7 A. Yes.

8 Q. Just a hypothetical,
9 1 millisecond.

10 So algorithm 1 would then
11 process the graph in 10 milliseconds; is that
12 correct?

13 A. That is always a factor. So --
14 so we need to say what this factor is.
15 Because $O(N)$ -- $O(N)$ is equal K factor N .
16 Quarter [phonetic] N is the number of nodes
17 and is the costs associated with visiting or
18 processing each one of these nodes.

19 Q. Okay. So let's -- let's --
20 let's assume -- I want to use really simple
21 numbers. Let's assume K is a quarter
22 [phonetic] 2.

1 A. Yeah.

2 Q. Just a hypothetical and a
3 simple example.

4 So in that case, then, would it
5 be accurate to say that algorithm will --
6 algorithm 1 will take 20 milliseconds?

7 A. Yes.

8 Q. But then algorithm 2 will be 2
9 times 100, so 200 milliseconds?

10 A. Yes.

11 Q. Okay. And so let us say these
12 are algorithms are run 1s, and they process
13 the graph.

14 Now, if algorithm 1 wants to
15 process another graph that has ten different
16 nodes --

17 A. Uh-huh.

18 Q. -- then -- and so let's suppose
19 that they're wanting to do this one after the
20 other, then they're staying with algorithm 1
21 in this example. So algorithm 1 process, the
22 graph the first time takes 20 milliseconds,

1 then maybe there is some reset period?

2 A. Uh-huh.

3 Q. And then it could process
4 the next -- the next graph. That would take
5 another 20 milliseconds?

6 A. Yes.

7 Q. And that process continues?

8 A. Uh-huh.

9 Q. Now, if you wanted to do the
10 same thing with algorithm 2, then now it --
11 now in this case it would take about
12 200 milliseconds?

13 A. Plus 200 milliseconds.

14 Q. So -- but I -- plus some basic
15 period plus then again 200 milliseconds; is
16 that correct?

17 A. That's accurate.

18 Q. Okay. So then can we then say
19 that the refresh rate of -- of algorithm 1 is
20 less -- or faster, right? I don't know what
21 is an accurate way to say it, but -- but I --
22 so we are -- we are doing the -- the graph --

1 processing different graphs one after the
2 other, and so can we say that algorithm 1
3 can -- can refresh new graphs faster than
4 algorithm 2?

5 A. Yeah. We -- the spec calls it
6 high area refresh rate.

7 Q. Okay. All right. Okay. Now,
8 so one -- one other thing is that it is -- I
9 remember during the discussion of this
10 refresh rate, you did give an example of high
11 compute cost of -- of one day.

12 A. Uh-huh.

13 Q. And I noted another word you
14 did mention that this is an extreme example,
15 extreme case.

16 What do you mean by that?

17 A. So we have to go -- forget
18 hindsight with NVIDIA [phonetic] boards. We
19 need to go back 2015.

20 Q. Uh-huh.

21 A. So you may run some of this --
22 let's say genetic algorithm. I think I

1 mentioned the example of genetic algorithm.

2 It take two days.

3 Q. Okay.

4 A. Don't forget all these are
5 different versions of optimizations problems
6 that we solve.

7 Q. And are -- is genetic algorithm
8 a -- a new learned word?

9 A. No.

10 Q. Okay. So when you say high --
11 so now as described in this patent,
12 '711 patent, when it says high compute cost,
13 does it mean one day or more?

14 A. No. I think it has more --
15 more in the order of milliseconds.

16 So you want something which is
17 in the order of a couple of milliseconds
18 because we are talking about the drone and
19 high-speed drones.

20 And then we're talking
21 something in the order of 20 or
22 50 milliseconds for the slow --

1 Q. So --

2 A. -- version.

3 Q. So when it says low compute
4 cost, that would be single-digit
5 milliseconds?

6 A. Yeah.

7 Q. And when it says high compute
8 cost, that would be tenths?

9 A. Tenths or hundredths.

10 Q. Or hundredths.

11 And average would
12 be somewhere in the -- somewhere in between?

13 A. Yeah. Then you need to decide
14 how often you are going to invoke this.

15 Q. Okay. All right.

16 Now let us go to -- to Pierce
17 and I will give you the exhibit number. I'm
18 finding it myself. It is 1005.

19 A. I'm there.

20 Q. And do you -- give me one
21 second to collect my thoughts here. Okay.

22 Could you please turn to

1 Figure 6. I believe -- I will double-check
2 if I'm -- yes, figure -- Figure 6, yes.

3 A. Yes.

4 Q. Do you recall discussing this
5 Figure 6 earlier?

6 A. I do.

7 Q. Does Figure 6 show a drone
8 anywhere?

9 A. No.

10 Q. Okay. And you mention a typo
11 because there is a bus 615 and then there is
12 also an object tracking module 615.

13 Do you see that in this figure?

14 A. Yes, and there is a bus 615.

15 Q. Okay. So for -- for -- for the
16 purposes of our discussion, let us ignore the
17 bus 615. Let's just focus on the object
18 tracking module 615.

19 A. Uh-huh.

20 Q. But there is no --

21 A. Yes.

22 Q. -- drone in this figure. Is

1 that --

2 A. No.

3 Q. Okay. Now -- now let us go to
4 Paragraph 42.

5 A. Yes.

6 Q. Can you please read the full
7 sentence of Paragraph 40-42.

8 A. "Figure 6 illustrates one
9 example of a drone system 600 that can be
10 used in conjunction with the techniques and
11 mechanisms" --

12 (Discussion off the record.)

13 A. So: "Figure 6 illustrates one
14 example of a drone system 600 that can be
15 used in conjunction with the techniques and
16 mechanisms of the present disclosure in
17 accordance with one or more embodiments."

18 (BY MR. WADEKAR)

19 Q. So you see that Figure 6
20 illustrates one example? You -- you see
21 that?

22 A. Yes.

1 Q. Okay. Now, the next sentence,
2 we -- we focused on this, it says: "In
3 various embodiments drone system may be drone
4 102."

5 You see that, right?

6 A. Yes.

7 Q. So now do you recall we also
8 discussed Paragraph 45?

9 A. Let me read it. Just give me a
10 minute. Yes.

11 Q. You don't have to read this out
12 loud but just for yourself or if you prefer
13 aloud, would you mind reading the first
14 sentence of Paragraph 45.

15 A. "Drone system 600 may further
16 include camera 605, global position 607,
17 velocity detector 613, object tracking
18 module 615, and laser tracking 617."

19 Q. Okay. Do you see the words
20 "may further include"?

21 A. Yes.

22 Q. And what does that inform you?

1 A. That you may have additional
2 components.

3 Q. And which would be those
4 additional components?

5 A. The object tracking module, the
6 velocity detector, the global position
7 system.

8 Q. So is it your understanding
9 that these are not always -- these components
10 that you just mentioned, they are not always
11 included in drone system 600?

12 A. That's my understanding.

13 Q. But they could be?

14 A. It's pretty high-level
15 description disclosure.

16 Q. Right. But -- but it says,
17 right --

18 A. Yeah.

19 Q. -- it says "may further," so it
20 is possible?

21 A. Yeah.

22 Q. But not -- not essential,

1 not -- not always?

2 A. Yeah.

3 Q. Okay. So now let us go to
4 Paragraph 212 of your declaration.

5 A. Yes.

6 Q. When we were discussing this
7 paragraph, you -- you mentioned a -- a typo;
8 but if I understand correctly, that typo was
9 with respect to Paragraph 213.

10 Is that not -- you mentioned
11 substitute claim 11 but that was claim 21; is
12 that correct?

13 A. Yeah. Let me read both
14 paragraphs.

15 Q. Okay.

16 A. Just give me a couple of
17 minutes.

18 Q. Sure.

19 A. So there is a second typo.
20 Sorry.

21 So the 36.d --

22 Q. Uh-huh.

1 A. -- element reads: "Wherein the
2 detecting of the target in the image
3 performed using a first neural network at a
4 first robustness and a first compute cost,
5 and the determining of the three dimensional
6 relative location of the target in the image
7 comprises incrementally predicting the
8 location of the target in the image..."

9 So I don't think -- and it says
10 "using a second neural network at a second
11 robustness."

12 So I think somehow I left from
13 there the second neural network just by
14 copying this.

15 Q. Okay.

16 A. And the second compute cost.

17 Q. Okay. So that -- and that was
18 the --

19 A. And then I have -- and then I
20 have also -- I believe I said the typo -- let
21 me go -- so the thing which is inside quotes
22 in 2012 in these two have the substitute

1 claim language for 36, the exact one.

2 And I think that 213, instead
3 of 11, should be -- let me figure out, it
4 should be 21.

5 Q. Okay. Thank -- thank you for
6 that.

7 I was going to ask you about
8 the typo that you just mentioned that --
9 just -- so just to clarify, you're saying
10 that the quoted language in 212, it says --
11 where it says "incrementally predicting the
12 location of the target in the image," then --
13 then it should say "using a second neural
14 network"?

15 A. Yeah. Because it says "at the
16 second robustness," it's "the second compute
17 cost."

18 Q. Okay.

19 A. So the -- the second neural
20 network is missing.

21 Q. Okay. And then if you turn to
22 Paragraph 213, is it -- is it your opinion --

1 I'm just going to read it from here, so it
2 says here that Beard -- and it mentions some
3 other references -- are silent on using
4 neural networks.

5 Is that -- is that your
6 opinion?

7 A. Yeah. In fact, it's not only
8 using neural networks, using a second neural
9 network for the case of Beard.

10 Q. Okay. And when -- when did --
11 the second neural network or the first one,
12 what data is the neural network using?

13 A. Images.

14 Q. Images. Okay.

15 And then it is using those
16 images to -- so let me read the claim
17 language back.

18 So it says for incrementally
19 predicting the location of the target it is
20 using the images; is that correct?

21 A. Yes.

22 Q. Okay. And so now let us turn

1 to Beard. It is reference 1009.

2 Let me know when you have it.

3 A. Just a minute.

4 Is 9 -- I need to upload it.

5 Yes, I'm there.

6 Q. Okay. And could you please go
7 to Column 6, Line 65.

8 A. Which line, you said?

9 Q. Line 65. Column 6, Line 65.

10 A. Yes, I'm there.

11 Q. And do you see that at the end
12 of the page it says here: "...in order to
13 predictively analyze."

14 The word "predictively analyze"
15 continue in Column 7.

16 Do you see that, "in order to
17 predictively analyze the future position"?

18 A. Let me -- let me see which line
19 you're referring to.

20 Q. The line number -- exact line
21 number is 67.

22 A. So "the action camera system

1 200 further processes."

2 Q. Yes, that -- if you want to
3 read the whole sentence, feel free to do
4 that.

5 A. "...the action camera system
6 200 further processes position data received
7 from smartphone 140 in order to predictively
8 analyze the future position or future
9 direction of skier 118."

10 Q. Okay. So based on this, can
11 you tell me what data is used? And I will
12 just go to "to predictively analyze the
13 future position," what data is used?

14 A. The position data provided from
15 the smartphone.

16 Q. And what is position data?

17 A. The GPS information from the
18 smartphone.

19 Q. And that is not the same thing
20 as an image; is that correct?

21 A. Yes.

22 Q. Okay.

1 A. That's true.

2 Q. Now, let us go back to
3 Paragraph 87 of the declaration.

4 A. 18?

5 Q. 87.

6 A. Yes.

7 Q. And you provide a definition of
8 autonomous navigating, is that correct, in
9 this paragraph?

10 A. Yes.

11 Q. Okay. And we discuss the
12 footnote, Footnote 2. And in the footnote,
13 you said: "...that the POPR -- the POPR
14 presented not the same but a similar
15 meaning."

16 Do you see that?

17 A. I see it.

18 Q. Yeah. And excuse me, we
19 discussed about what is -- what "similar"
20 means, and so would you mind taking a look at
21 the -- the definition that is from the
22 POPR -- you recall that Paper 11, we looked

1 at Paper 11 is -- Paper 11 is the -- is the
2 POPR.

3 Do you recall that?

4 A. Yes.

5 Q. And that definition is quoted
6 here. The -- would you mind reading that?

7 A. Yeah. Can you tell me where?
8 Which page?

9 Q. Oh, it is in the footnote. But
10 if you prefer, go -- look at the POPR, that
11 is on Page 30 of the POPR.

12 A. Yeah. It say it's:
13 "Performing navigation by the reference UAV
14 itself."

15 Q. Okay. And then let us go back
16 to Paragraph 87.

17 A. So the difference is I added a
18 stronger statement by itself by saying
19 without outside control.

20 And instead of saying
21 performing, I said it's making the navigation
22 decisions.

1 Q. Okay.

2 A. That's why I said similar.

3 Q. Okay.

4 A. But, again, I try -- as I
5 mentioned earlier, I tried to look at it
6 based on the language.

7 I don't think...

8 Q. Okay. And now, do you recall
9 that you were asked a few times what -- what
10 navigation decision is or what navigation
11 decision means?

12 Do you recall that discussion?

13 A. Yes.

14 Q. And at one point in time, you
15 mentioned that navigation decision is where
16 and how to move, do you do you recall that,
17 am I -- I'm paraphrase -- I may be
18 paraphrasing, but -- but I think this is what
19 you said, where and how to move.

20 Do you recall that?

21 A. Yeah.

22 Q. Okay. And then there are also

1 flight decisions. And there is more
2 specifically performing flight decisions,
3 right?

4 A. Yes.

5 Q. So is there a flow or -- or
6 association of link, whichever way you want
7 to describe it, between making navigation
8 decisions and performing flight decisions?

9 A. One refers to making of the
10 decision, the determination of the -- making
11 a decision. And then the performing, it has
12 the component of executing the decision. In
13 other, words you actuate your system.

14 Q. Okay. And so then let's go to
15 the '711 patent, which is Exhibit 1001.

16 A. Yes.

17 Q. If you go to Column 9, and --

18 A. Just one minute.

19 Q. Yeah. Sorry. Sorry.

20 A. Yes.

21 Q. Okay. Column 9, if you go to
22 Line 7.

1 A. Yes.

2 Q. Do you see here that Figure 3
3 is a UAV in accordance with some embodiments?

4 A. Yes.

5 Q. Okay. And then in Line 11 --
6 continuing with Line 11, it says here that
7 the UAV -- or it says: "...unmanned aerial
8 vehicle 301 comprising -- comprising
9 computing chassis 302."

10 Do you see that?

11 A. Yes.

12 Q. Okay. Now, in the same column
13 at Line 25, 26, do you see that the computing
14 chassis 302 is configured to protect the CPU
15 of UAV 301?

16 You see that?

17 A. That's true.

18 Q. Yeah. And you quoted the
19 statements from your declaration earlier, and
20 then -- then you mentioned there that the CPU
21 is configured -- configured to control the
22 overall operation of UAV 301.

1 You recall that?

2 A. Yes.

3 Q. Now, in -- in the same column,
4 if you go to Line 38, Column 9, Line 38?

5 A. Yes.

6 Q. So if -- if you don't mind,
7 read the paragraph -- or the lines starting
8 from Line 38 through 40 -- 40 -- 44 or 45.

9 And you don't have to read it
10 out loud. Just familiarize yourself, please.

11 A. Yes.

12 Q. So do you see that it says here
13 that the CPU may be configured to perform one
14 or more flight decisions for the UAV?

15 A. I do.

16 Q. And then in the very next
17 sentence, it says: "The CPU may provide one
18 or more flight commands to a flight
19 controller module."

20 Do you see that?

21 A. That's true.

22 Q. So is it fair to say that this

1 is the flow that you mentioned earlier that
2 making a decision and then executing the
3 decision?

4 A. That's -- that's what these
5 specs discloses.

6 Q. And then you see some examples
7 here in the lines that I mentioned, a flight
8 command may include a specified speed.

9 You see that?

10 A. That's true.

11 Q. A specified flight height?

12 A. Yes.

13 Q. A particular flight path?

14 A. That's true.

15 Q. Are these examples of --
16 what -- what -- these are examples of what?

17 A. Of a flight command or what the
18 flight command may include, just...

19 Q. Okay. And does that relate to
20 navigation in any way?

21 A. Absolutely.

22 Q. How?

1 A. You actuate -- if we -- if we
2 move to 43, in the response to the one or
3 more flight commands, the flight controller
4 module is configured to control the motor
5 associated with a UAV.

6 For example, motors 304a, 304b.
7 "...so that UAV 301 flies in a manner that is
8 consistent with the flight commands."

9 Q. So now going back to Line 38,
10 39, it says here: "One or more flight
11 decisions."

12 Then it says "for example," and
13 then it gives the -- it says that it provides
14 one or more flight commands.

15 And then, again, it says, for
16 example, a flight command may include, as you
17 pointed, out these different things?

18 So how -- is -- is the flight
19 decision related to these examples here
20 like -- like a particular flight path, for
21 example, is -- are those two related?

22 A. Yeah. Because a flight

1 decision may include one or more flight
2 commands. And these are some of the examples
3 which are mentioned here, some examples of
4 flight commands.

5 And then in response to these
6 particular flight commands, the flight
7 controller unit just actuates in a certain
8 way or in a control way the motors of the
9 UAV.

10 Q. So if I understand correctly,
11 the -- the -- the specified speed, as it says
12 here --

13 A. Yeah.

14 Q. -- "specified speed for the
15 UAV," is that an example of a flight decision
16 or at least part of it?

17 A. It's the flight decision and
18 its outcome, its execution.

19 Q. Okay. But -- but -- so
20 somebody -- so --

21 A. So we have a closed loop.
22 Sorry - sorry to interrupt.

1 Q. No, no. Go ahead.

2 A. We have a closed loop. So I
3 have images. We are coming in. The CPU and
4 indicated processors and the neural networks
5 or the vacillating model processes them
6 within the vehicle.

7 (Discussion off the record.)

8 A. So we have images of the
9 target. They are coming in.

10 The neural network model, as
11 referenced in the claims, substitute claims,
12 process them.

13 It may do things such as
14 classification, determination of location,
15 and then starts making flight decisions.
16 It's closing the loop, we call them.

17 The flight decisions may
18 include flight commands. Some of the flight
19 commands may be specified speed, specified
20 flight height, specific numbers for the
21 height or the speed, or a particular flight
22 path. In other words, a set of nodes that

1 the UAV may visit.

2 As a response to the flight
3 commands you have activation of the flight
4 controller module, which is -- whose job is
5 basically to actuate the motors, to control
6 the motors.

7 (BY MR. WADEKAR)

8 Q. So when they adjust the
9 specified speed, as an example --

10 A. Uh-huh.

11 Q. -- you mentioned the specified
12 speed is an outcome.

13 Is it an outcome of a flight
14 decision so --

15 A. Yes.

16 Q. So the CPU decided what the
17 speed should be?

18 A. Yes, based on the algorithm
19 that is run.

20 Q. And then specified that as --
21 by including it in the command?

22 A. Yes.

1 Q. Okay. Now let us go to
2 claim 12.

3 A. And where should I go, in the
4 patent?

5 Q. In the patent, yes. I'm sorry.
6 In the patent itself.

7 A. Yes.

8 Q. So do you recall that there was
9 some discussion about whether claim 12
10 recites any components -- let me step back
11 for a moment.

12 You recognize that this is a
13 method claim? Do you recognize -- you
14 recognize that?

15 A. I do.

16 Q. Right. Okay.

17 Do you recall the discussion
18 that the -- there was some questions about
19 whether there is a component that recites or
20 that -- that -- is there a component
21 mentioned here that performs these steps, do
22 you recall that discussion?

1 A. Yes.

2 Q. Okay. So looking at the
3 element -- second element, autonomously
4 navigating.

5 A. Yes.

6 Q. Does that element as a whole
7 specifically say what thing -- I -- I want
8 to -- maybe there was some confusion about
9 the word "component," so I'm going to say
10 "what thing."

11 What thing does autonomously
12 navigate?

13 A. The reference aerial vehicle
14 towards autonomously navigating the aerial --
15 the reference aerial vehicle towards the
16 received geographical location.

17 Q. Let me -- let me go back. Let
18 me take --

19 Does that -- does the element
20 as -- as you read it, does it say explicitly
21 that it is the autonomous -- no, sorry, my
22 mistake.

1 Does the -- does the element
2 say explicitly that the reference aerial
3 vehicle performs autonomously navigating,
4 does it say that explicitly?

5 A. I think it's explicit.

6 Q. I -- I think what you're saying
7 is that it is clear to you, but it is --

8 A. Yeah.

9 Q. -- it's not explicit. It is
10 not stated in the -- in the -- in the element
11 itself.

12 It is -- so let me ask it this
13 way: Does -- does the claim element say
14 autonomously navigating by the reference
15 aerial vehicle, not -- and then, again, says
16 navigating the reference aerial vehicle?

17 A. It doesn't say "by."

18 Q. Yeah.

19 A. But it would be so redundant --
20 it doesn't say "by."

21 Q. Okay. And why -- why would it
22 be redundant?

1 A. Because I think a POSITA will
2 understand that this is autonomous navigation
3 of the reference aerial vehicle, not only --
4 but based on the whole spec.

5 Q. And this follows from your
6 definition of what -- how you define the term
7 "autonomously navigating"?

8 A. Yeah. Because I -- I use also
9 the spec language in order to.

10 So it may not have the explicit
11 "by," but, to me, it's very clear what is
12 going on.

13 Q. Okay. All right.

14 MR. WADEKAR: And that is --
15 that is all I have for Professor
16 Nikos, and I would like to pass the
17 witness.

18 MR. WALTERS: No further
19 questions from me.

20 MR. WADEKAR: Okay.

21 (The deposition concluded at 2:13 p.m.)

22

1 WITNESS CORRECTIONS AND SIGNATURE

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22 DR. NIKOLAOS PAPANIKOLOPOULOS

1 S I G N A T U R E O F W I T N E S S

2 I, DR. NIKOLAOS PAPANIKOLOPOULOS,
3 solemnly swear or affirm under the pains and
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17

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20 My Commission Expires: _____

21

22 Job 620988

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD
4 AXON ENTERPRISE, INC., DEDRONE HOLDINGS, INC.,
5 AND SKYDIO, INC.
6 Petitioners
7 v.
8 AIRSPACE DEFENSE, INC.
9 Patent Owner

10
11 Case No. IPR2025-00629
12 Patent 10,514,711

13 ~~CERTIFICATE OF SHORTHAND REPORTER~~

14 I, Mendy A. Schneider, Certified
15 Reporter within and for the State of Texas
16 do hereby certify:

17 That DR. NIKOLAOS PAPANIKOLOPOULOS, the
18 witness whose deposition is hereinbefore set
19 forth, was duly sworn by me before the
20 commencement of such deposition and that such
21 deposition was taken before me and is a true
22 record of the testimony given by such

1 witness.

2 I further certify that the adverse
3 party was represented by counsel at the
4 deposition.

5 I further certify that the deposition
6 of DR. NIKOLAOS PAPANIKOLOPOULOS, occurred
7 remotely on Thursday, February 26, 2026,
8 commencing at 9:04 a.m. to 2:13 p.m.

9 I further certify that I am not related
10 to any of the parties to this action by blood
11 or marriage, I am not employed by or an
12 attorney to any of the parties to this
13 action, and that I am in no way interested,
14 financially or otherwise, in the outcome
15 of this matter.

16

17 IN WITNESS WHEREOF, I have hereunto set
18 my hand this 28th of February 2026.

19

20

21

22

Mendy A. Schneider
MENDY A. SCHNEIDER, CSR, RPR
Certification No.: 7761
Expiration Date: 1-31-2027

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Conducted on February 26, 2026

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Re: Deposition of **Nikolaos Papanikolopoulos, Ph.D.**

Date: 2/26/2026

Case: Axon Enterprise, Inc., et al. -v- Airspace Defense, Inc. (PTAB)

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Date: 2/26/2026

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Page	Line	Correction / Change and Reason
8	18	"..." s/b "computer" (transcription error)
11	10	ADD: end quotation mark after the period (transcription error)
12	18	"scale of" s/b "scalar" (transcription error)
18	17	"interchangeable" s/b "interchangeably" (transcription error)
24	17	"speed" s/b "limit" (transcription error)
26	15	"the" s/b "that" (transcription error)
35	3	"neuron" s/b "neural" (transcription error)
41	10	"code" s/b "drone" (transcription error)
41	11	"codes" s/b "locates" (transcription error)
44	6	"or" s/b "for" (transcription error)
45	19	"grouped out" s/b "grouped" (transcription error)
49	7	"is this being titled" s/b "this is being tiled" (transcription error)
49	8	"mention a modify" s/b "mentions a modified" (transcription error)
54	13	"depends, the" s/b "depends, on the" (transcription error)
55	7	"issue" s/b "issues" (transcription error)
58	3	"mode" s/b "remote" (transcription error)
63	14	"On" s/b "And" (transcription error)
64	3	"is" s/b "are" (transcription error)
64	5	"staff" s/b "stuff here" (transcription error)
64	6	"disclosed," s/b "disclosed in 711;" (transcription error)
65	11	"look" s/b "looked" (transcription error)
66	12	"applying a" s/b "applying at a" (transcription error)

March 6, 2026

(Date)



(Signature)

Re: Deposition of **Nikolaos Papanikolopoulos, Ph.D.**

Date: 2/26/2026

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Page	Line	Correction / Change and Reason
71	15	“this” s/b “these” (transcription error)
76	3	“not” s/b “no” (transcription error)
76	21	“perform on board” s/b “performed onboard” (transcription error)
85	9	“lead” s/b “leads” (transcription error)
91	15	ADD: end quotation mark after the period (transcription error)
93	19	“doesn’t from” s/b “doesn’t come from” (transcription error)
94	11	“system or system” s/b “system or systems” (transcription error)
98	7	“—” s/b “POPR” (transcription error)
98	8	“pick” s/b “define” (transcription error)
98	20	“construction” s/b “constructions” (transcription error)
100	9	“is” s/b “are” (transcription error)
100	10	“focus the” s/b “focus on the” (transcription error)
101	2	“is important” s/b “is the important” (transcription error)
106	19	“navigate” s/b “navigation” (transcription error)
114	14	“locate to the” s/b “locate near the” (transcription error)
114	14	“to do” s/b “to be” (transcription error)
114	16	“rejoin” s/b “allow using its own” (transcription error)
120	17	“is” s/b “are” (transcription error)
121	11	“or” s/b “in” (transcription error)
134	14	“duration” s/b “of the degrees of freedom involved” (transcription error)
134	17-18	“on both” s/b “onboard” (transcription error)

March 6, 2026

(Date)

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(Signature)

Re: Deposition of **Nikolaos Papanikolopoulos, Ph.D.**

Date: 2/26/2026

Case: Axon Enterprise, Inc., et al. -v- Airspace Defense, Inc. (PTAB)

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Page	Line	Correction / Change and Reason
135	19	“control” s/b “be controlled” (transcription error)
136	14	“smaller” s/b “smaller in scope” (transcription error)
136	18	“went” s/b “want” (transcription error)
138	1	“has it on board” s/b “has onboard” (transcription error)
146	7	“their” s/b “the” (transcription error)
148	13	“what” s/b “that” (transcription error)
148	13	“so on one” s/b “so in one” (transcription error)
149	21	“used” s/b “use” (transcription error)
150	3	“Then would that involve” s/b “That would involve” (transcription error)
151	21	“with structural” s/b “with the structural” (transcription error)
152	18	“limit” s/b “limit them” (transcription error)
154	5	“Venn” s/b “N” (transcription error)
156	7	“a little n 2” s/b “Algorithm 2” (transcription error)
156	11	“N” s/b “ten” (transcription error)
156	17	“one” s/b “once” (transcription error)
157	2	“automatical” s/b “mathematical, rough” (transcription error)
157	13	“That” s/b “There” (transcription error)
157	15	“equal K factor N” s/b “equal to K times N” (transcription error)
157	16	“Quarter” s/b “Parameter” (transcription error)
157	17	“and is” s/b “and K is” (transcription error)
157	21	“a quarter” s/b “equal to” (transcription error)

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Page	Line	Correction / Change and Reason
158	12	"1s" s/b "once" (transcription error)
158	21	"process" s/b "processes" (transcription error)
159	14	"basic" s/b "reset" (transcription error)
160	6	"high area refresh" s/b "high refresh" (transcription error)
161	1	"of genetic" s/b "of a genetic" (transcription error)
161	2	"It take" s/b "It may take" (transcription error)
161	8	"new learned word" s/b "neural network" (transcription error)
166	14	"It's pretty" s/b "It's a pretty" (transcription error)
170	9	"Beard" s/b "Beard is absent" (transcription error)
174	12	"say" s/b "says" (transcription error)
179	5	"discloses" s/b "disclose" (transcription error)
180	4	"motor" s/b "motors" (transcription error)
181	8	"control" s/b "controlled" (transcription error)
182	3	"We" s/b "They" (transcription error)
182	5	"vacillating" s/b "machine learning" (transcription error)
182	22	"nodes" s/b "locations" (transcription error)

March 6, 2026
(Date)



(Signature)

No. 620988

Re: Deposition of **Nikolaos Papanikolopoulos, Ph.D.**
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ACKNOWLEDGMENT OF DEPONENT

I, Nikolaos Papanikolopoulos, Ph.D., do
hereby acknowledge that I have read and examined the
foregoing testimony, and the same is a true, correct
and complete transcription of the testimony given by
me and any corrections appear on the attached Errata
sheet signed by me.

March 6, 2026

(Date)



(Signature)

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