

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD

3 SZ DJI TECHNOLOGY CO., LTD.,
4 Petitioner,
5 v.
6 AUTEL ROBOTICS USA LLC,
7 Patent Owner,

8 Case IPR2019-00343
9 Patent 9,260,184 B2

10 Case IPR2019-00014
11 Patent 9,979,000 B2

12 Case IRP2019-00016
13 Patent 10,044,013 B2

14 CONTINUED DEPOSITION OF DR. CHARLES REINHOLTZ

15 Friday, November 15, 2019

16 8:04 a.m. - 12:02 p.m.

17
18
19 Marriott Orlando Airport
20 7499 Augusta National Drive
21 Orlando, Florida 32822

22 Stenographically Reported By:
23 Jeana Kim, CRR, RMR, FPR, CLR
24 Certified Realtime Reporter
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EXHIBITS PREVIOUSLY MARKED

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6	No. 9,260,184)	
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17	('184 proceeding - "The User Manual	
18	md4-200 Version 2.2)	
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1 P R O C E E D I N G S

2 - - -

3 Deposition taken before Jeana Kim, Registered
4 Realtime Reporter and Notary Public in and for the State
5 of Florida at Large, in the above cause.

6 - - -

7 Thereupon,

8 (DR. CHARLES REINHOLTZ)

9 having been first duly sworn or affirmed, was examined
10 and testified as follows:

11 THE WITNESS: I do.

12 CROSS (DR. CHARLES REINHOLTZ)

13 BY MS. GORDON:

14 Q. Good morning. Would you please state your
15 full name for the record.

16 A. Yes. Charles Frederick Reinholtz.

17 Q. And Dr. Reinholtz, have you been deposed
18 before?

19 A. I have.

20 Q. So you know the ground rules for a deposition
21 fairly well?

22 A. I think so.

23 Q. I just want to go through the biggy. I'm
24 going to ask you questions, and I need you to answer
25 orally, verbally.

1 A. Yes.

2 Q. And if at any time my question is unclear and
3 you don't understand, just let me know and I'll try and
4 reframe the question for you. Does that seem fair?

5 A. That's fair. Thank you.

6 Q. And Dr. Reinholtz, is there any reason that
7 you can think of that you cannot testify truthfully here
8 today?

9 A. No.

10 Q. And you understand that you are here to
11 testify regarding the testimony you submitted by
12 declaration in the United States Patent and Trademark
13 Office inter partes review proceeding of the U.S. Patent
14 No. 9,260,184?

15 A. Yes.

16 Q. And for purposes of today's deposition, can we
17 refer to the 9,260,184 patent as the '184 patent?

18 A. That would be convenient, yes.

19 Q. And you understand that you are also here
20 today to testify regarding the declaration you submitted
21 in the United States Patent and Trademark Office
22 proceeding of U.S. Patent No. 9,979,000 and 10,044,013?

23 A. Yes.

24 Q. And for ease of discussion, can we refer to
25 these as the '00 patent and the '013 patent?

1 A. Yes, that would be fine.

2 Q. Okay.

3 MR. ABRAMIC: I think you meant '000.

4 MS. GORDON: What did I say?

5 MR. ABRAMIC: I think you just had it with two
6 zeroes. I just wanted to make sure it was clear.

7 MS. GORDON: Yes, three zeros.

8 BY MS. GORDON:

9 Q. So I'm going to hand you documents that we
10 will be discussing today so you have them in front of
11 you.

12 I'm handing you what's been marked as
13 Exhibit 2010 in IPR 2019-00343. It's entitled "The
14 Declaration of Dr. Charles Reinholtz."

15 A. I have it.

16 Q. Dr. Reinholtz, do you recognize this document?

17 A. I do.

18 Q. And did you review this document in
19 preparation for today's deposition?

20 A. I did.

21 Q. I'm handing you what's been marked as DJI
22 Exhibit 1001 in IPR 2019-00343. This document is
23 entitled "U.S. Patent No. 9,260,184."

24 Do you recognize this document?

25 A. I do.

1 Q. And did you review this document in
2 preparation for today's deposition?

3 A. I didn't review the whole document recently,
4 but I have reviewed it in the past.

5 Q. So you're familiar with the document?

6 A. Generally, yes.

7 Q. Okay. I'm handing you what's been marked as
8 Exhibit 2001 in PGR 2019-00014 entitled "The Declaration
9 of Dr. Charles Reinholtz."

10 A. Okay. I have this.

11 Q. And Dr. Reinholtz, do you recognize this
12 document?

13 A. Yes, I do.

14 Q. Did you review this document in preparation
15 for today's deposition?

16 A. I did.

17 Q. I'm handing you what's been marked as
18 Exhibit 1001 to the same proceeding. It's U.S. Patent
19 No. 9,970,000.

20 Do you recognize this document?

21 A. I do.

22 Q. And did you review this document in
23 preparation for today's proceeding?

24 A. I skimmed through it. I reviewed it in the
25 past, but I didn't review it --

1 Q. So you're familiar with this document?

2 A. I am, yes.

3 Q. And I am handing you what's been marked as
4 Exhibit 2001 in PGR 2019-00016, again, entitled the
5 declaration -- or "The Corrected Declaration of
6 Dr. Charles Reinholtz."

7 A. Okay. I have it.

8 Q. And do you recognize this document?

9 A. I do.

10 Q. And did you review this document in
11 preparation for today's deposition?

12 A. Yes, I did.

13 Q. So I'd like to start with your declaration in
14 the '184 proceeding --

15 A. Okay.

16 Q. -- which was the first one I handed to you.

17 A. Okay. I have it.

18 Q. Can you turn to page 50. I think it's --
19 yeah, it's --

20 A. I have it, yes.

21 Q. Is that your signature on this document?

22 A. It is, yes.

23 Q. And you signed this document on August 27,
24 2019?

25 A. That's correct.

1 Q. Let's turn to page 1, paragraph 1 of this
2 declaration.

3 A. Are you referring to -- I think the previous
4 page number you referred to was associated with the
5 exhibit number.

6 Q. I'm sorry.

7 A. No, I just want to make sure we're clear. I
8 think I know where you are.

9 Q. Yeah, I'm sorry. I didn't realize there were
10 two sets of numbers on here.

11 For ease of discussion, let's use the page
12 number that's actually embedded in the document, not the
13 one that's in the Bate stamps.

14 A. Okay.

15 Q. So use page 1 instead of page 5.

16 A. Okay.

17 I wouldn't be surprised if we get confused
18 during the day at some point, but we'll try to stick on
19 the same page.

20 Q. I'll try to also call out the paragraph
21 numbers so there is no confusion.

22 A. That would help. Thank you.

23 Q. So in paragraph 1, you state, "I have been
24 retained as an expert in this matter by counsel for
25 patent owner, Autel Robotics."

1 What counsel retained you for this matter?

2 A. Steptoe counsel.

3 Q. And did they retain you specifically for this
4 IPR matter?

5 A. I don't recall the discussion of the IPR early
6 on. I believe so. There was also a separate ITC case
7 that I worked on.

8 Q. And approximately, when were you first
9 contacted to work on this matter?

10 A. I believe it was late last year or early in
11 the new year. But I don't have that date in mind.

12 Q. Okay. Late 2018?

13 A. I can't be certain. It might have been even
14 as late as the spring of this year. I'd have to look
15 back at my records on that.

16 Q. And was that when you were retained to work on
17 the ITC matter as well?

18 A. That's correct. As I think about it, I think
19 it was a little later, maybe in March of this year. But
20 again, I don't have a firm date in mind.

21 Q. And were you retained for the '000 and '013
22 proceedings at the same time?

23 A. I can't recall if there was a discussion at
24 that time about the '000 patent. I believe so.

25 Q. And the '013 patent?

1 A. Yes, I was generally retained to work on this,
2 broadly, on the patents at issue here. I don't recall
3 the specifics of whether at the time of my retention the
4 particular patent number, '000, was mentioned.

5 Q. Okay. Understood.

6 And the subject matter contained in the '184
7 declaration, was that prepared solely for the '184 IPR
8 proceeding?

9 A. Well, the subject matter that is in this
10 declaration is related to the subject matter in the ITC
11 proceeding. So there is certainly overlap.

12 Q. Okay. So some of the subject matter may have
13 been prepared for the ITC proceeding and used in the IPR
14 proceeding?

15 A. Well, the declaration certainly was written
16 with the focus on the IPR proceeding. But certainly my
17 colleage of the case was predicated on work that I did
18 related to the ITC hearing.

19 Q. Did you prepare a document for the ITC
20 proceeding?

21 A. I did.

22 Q. And what document was that? Or maybe what
23 document related to the invalidity or the validity of
24 the '184 patent?

25 A. I'm quite sure I submitted a report or

1 declaration discussing the validity issues.

2 Q. And about what time period was that
3 declaration prepared?

4 A. Over the summer. I would say in June or July.

5 Q. So before the declaration was prepared for the
6 '184 proceeding?

7 A. Yes. That's correct.

8 Q. And when preparing the '184 declaration, did
9 you consult with anyone other than counsel?

10 A. Not to my recollection.

11 Q. And other than the ITC matter, have you been
12 retained to opine on the '184 patent in another
13 proceeding?

14 A. No.

15 Q. And have you been retained to opine on the
16 '000 patent in another proceeding?

17 A. No.

18 Q. Have you been retained to opine on the '013
19 patent in another proceeding?

20 A. No.

21 Q. So you didn't opine on the '013 patent in the
22 ITC proceeding?

23 A. I'm sorry, I thought you meant excluding the
24 ITC proceeding.

25 Q. Did I say that?

1 A. No. No. I inferred that from the question
2 since you had asked it about the '184.

3 So the '013 patent was subject of the ITC
4 case, and I did opine on it related to that case.

5 Q. But other than the ITC proceeding, you've not
6 been asked to opine on the '013 patent in another
7 proceeding?

8 A. That's correct.

9 Q. And the '000 patent was not involved in the
10 ITC proceeding, correct?

11 A. That's correct.

12 Q. So I'd like to now turn to your background and
13 qualifications section.

14 A. Okay.

15 Q. Which is on page 2 of the declaration, which
16 has been stamped as page 5.

17 A. I'm with you.

18 Q. And this background section covers paragraphs
19 6 through 15. And these are the same paragraphs that
20 are in the declaration for the '000 and '013 patents,
21 correct?

22 A. I think so. I would have to compare them word
23 for word, but they should be -- if they're not
24 identical, they should be very similar.

25 Q. And so in the first paragraph, you mentioned

1 you're currently a professor at Embry-Riddle
2 Aeronautical University. How long have you been a
3 professor there?

4 A. Since 2007. May of 2007.

5 Q. And what classes do you teach?

6 A. I teach a variety of classes. I was, for the
7 first ten years at Embry-Riddle, I was the department
8 chair. I was hired as the founding chair of the
9 mechanical engineering program there. I have taught
10 freshmen introduction classes for mechanical engineering
11 students, a class called Introduction to Engineering. I
12 teach machine design and advanced machine design. I
13 teach a class called Mechanisms, which is about CAMs and
14 gears and linkages and latching mechanisms, for example.
15 I teach classes in unmanned systems at both the
16 undergraduate and graduate level. Currently, I'm
17 teaching a graduate level mechanisms class. And
18 probably my largest component of teaching has been
19 teaching the capstone senior design projects, which are
20 a year-long, eight credit -- eight credits over the
21 year. So it's a fairly intense design experience. And
22 I teach all of the capstone design courses in the
23 robotics track of mechanical engineering.

24 Q. And you mentioned the class you taught on
25 unmanned systems. Does that include UAV systems?

1 A. It does, yes.

2 Q. And is that a class that you taught since
3 2007?

4 A. I taught similar classes at Virginia Tech. So
5 prior to 2007, probably starting in the mid 1990s, I
6 taught classes in that area.

7 Q. And when you first started teaching classes on
8 unmanned systems in the mid 1990s, did that cover
9 unmanned aerial vehicles, UAVs?

10 A. It did. A lot of the technology overlaps
11 between unmanned ground vehicles and -- unmanned and
12 autonomous ground vehicles, surface vehicles, underwater
13 vehicles. And so the course generally covers unmanned
14 systems; air, ground, underwater, full-size passenger
15 cars in some cases.

16 Q. Okay. So I'd like to just focus on the UAV
17 aspect of the classes you taught. So when you first
18 started teaching at Virginia Tech in the mid '90s, what
19 types of UAVs did you encounter?

20 A. It's hard for me to recall the specifics. We
21 certainly discussed fixed and rotary wing aircraft.

22 Q. And were there any manufactures in the '90s
23 that you recall of fixed and rotary wing aircraft?

24 A. There are quite a number of hobby aircraft.
25 And many of the early unmanned vehicles were remote

1 control vehicles that gradually took on more levels of
2 autonomy.

3 I can't, off the top of my head, recall the
4 names of the manufacturers of those aircraft. With a
5 little digging, I could probably list several.

6 Q. Were you a UAV hobbyist in the mid '90s?

7 A. In the mid '90s, I would say no. It was
8 probably a little bit later for me.

9 Q. While at Virginia Tech, did you do any
10 research on UAV systems?

11 A. Yes, I did.

12 Q. And were there any particular manufacturers
13 that you focused on in your research?

14 A. One that comes to mind, we had a system called
15 the Yamaha R-MAX, which is a relatively large rotorcraft
16 relative to the size of the devices that we're typically
17 discussing; the Autel product, for example. So
18 relatively large rotary wing aircraft.

19 There was also an aircraft called -- rotary
20 wing aircraft called the Bergen, B-E-R-G-E-N, Industrial
21 Twin.

22 Q. In the Yamaha R-MAX, you said it was larger
23 than the Autel product. Can you give me a rough
24 estimate of the size of that?

25 A. It's -- I may not have been very clear. I

1 believe it's R-M-A-X, R-MAX, Yamaha R-MAX. I would say
2 it has a rotary span of about 6 feet.

3 Q. Was it a quadrotor?

4 A. No. It's a conventional, single rotor. It's
5 a conventional, single rotor with a tail rotor
6 helicopter.

7 Q. And the Bergen Industrial Twin, was that a
8 multi rotary -- I should say, quadrotor?

9 A. No. That was also a more conventional
10 helicopter configuration.

11 Q. And while you were at Virginia Tech, did you
12 do any research on any of the traditional quadcopter
13 UAVs?

14 A. Well, we had some small quadcopter UAVs. I
15 don't think we had any funded research. I worked with
16 students that flew them as hobbyists.

17 Q. And do you recall the manufacturers of those
18 small quadcopters?

19 A. No. I'm sorry.

20 Q. But you didn't do any research on quadcopters
21 in Virginia Tech?

22 A. I can't say with certainty. I can be pretty
23 certain that I didn't have funded -- externally funded
24 research. We certainly had an interest in rotary and
25 fixed wing aircraft of all types. We entered vehicles

1 in student competitions and we examined quadrotors;
2 single, conventional helicopter designs; fixed wing
3 aircraft. So I would say there was research, but not
4 externally funded research until we worked on the R-MAX,
5 I think might have been the earliest.

6 Q. So I'd like to turn to your time at
7 Embry-Riddle. What type of UAV systems did you discuss
8 in your unmanned systems course at that university?

9 A. Well, the types were the types that we've been
10 discussing. So quadrotor and multirotor. We worked on
11 both four and six-rotor -- rotary wing aircraft. We
12 also had a Bergen Industrial Twin that was part of the
13 research and teaching. We worked on a variety of both
14 commercially available fixed wing aircraft and custom
15 developed aircraft including some that we 3-D printed.

16 I think we may have had the earliest 3-D
17 printed flying fixed wing aircraft.

18 Q. Interesting.

19 So for the quadrotor systems, the four and
20 six-wing, were there any specific manufacturers that you
21 focused on in your coursework?

22 A. We have used a lot of different -- especially
23 quadrotors over the years. I can't -- I think -- there
24 is one called the Parrot. There is one DJI product. We
25 have some custom developed quadrotors.

1 We also did quite a lot of research on a
2 single-wing rotary aircraft that we referred to as a
3 monocopter that flies something like a maple seed as it
4 auto rotates and spins as it falls, except we had a
5 power version of that that we could fly.

6 There were many others. I just don't recall
7 all of the manufacturer names or details.

8 Q. And in your course, what specific topics would
9 you focus on when it related to UAVs?

10 A. Let me be clear. You, I think, earlier
11 referred to the unmanned systems course, which I taught
12 different versions of it at the undergraduate and
13 graduate level. But in my general teaching, including
14 especially in capstone design, we work with a variety of
15 different aircraft.

16 I'm describing broadly. I would have trouble
17 distinguishing an aircraft that we used in an
18 undergraduate course from -- from 12 years ago from
19 something that we used in capstone design, for example.
20 So I'm describing broadly things that we use in
21 teaching.

22 Q. Thank you for that clarification. I think
23 that's fine for the purposes of today.

24 A. Okay.

25 Q. So broadly in your teaching, what aspects of

1 UAV design do you focus on?

2 A. Pretty much everything that would be
3 encompassed in designing a functional aircraft from the
4 electronics. The power is a major issue, batteries.
5 The autopilots, the remote control technology, the
6 flight characteristics. The sensors are often a large
7 part of the research and sensor fusion. The structural
8 elements of the aircraft of the system in general. I
9 could go on and on about -- there are a lot of topics
10 of --

11 Q. Okay.

12 A. -- and teaching about unmanned systems
13 generally and aerial vehicles in particular.

14 Q. So you mentioned the Parrot product. Was that
15 the Parrot Bebop product?

16 A. Probably. My memory is not that clear.

17 Q. And what's your recollection of the first
18 commercial quadrotor product that was on the market?

19 A. I have seen products that date back to 2000,
20 very early on specific -- I think I mentioned at some
21 point the -- I think it's the Draganflyer. So broadly,
22 I was familiar with quadrotors rotor craft. Probably in
23 the late -- mid to late 1990s.

24 Q. Okay.

25 A. I should be clear about that. There are some

1 historically very interesting rotorcraft that date back
2 into the early 1900s. We had an interest in those too.
3 But the common experience with them I think was more
4 like the late 1990s, early 2000s.

5 Q. And who were in the late '90s and early 2000s?
6 What companies would you consider to be the innovators
7 in the commercial quadrotor UAVs?

8 A. I can't say.

9 Q. So you mentioned Draganflyer. Did Draganflyer
10 have a product in the early 2000s?

11 A. I'd have to refresh my memory on that. I'm
12 not sure. I think so.

13 Q. You mentioned the custom developed quadrotors.
14 What made them -- let me step back.

15 So your students developed custom quadrotors,
16 correct?

17 A. That's correct.

18 Q. I'm assuming, of course, they were remote
19 controlled, correct?

20 A. Well, remote control but with the intention in
21 many cases of being autonomous, meaning there are times
22 when they are not required to be controlled by a human.

23 Q. And did they use any off-the-shelf components
24 for those quadrotors?

25 A. Oh, yes. Of course.

1 Q. And would they use off-the-shelf rotor blades?

2 A. Yes. In almost all cases.

3 Q. And the drive shafts?

4 A. I think that's fair to say, yes.

5 Q. And what was the earliest custom developed
6 quadrotor that your students developed while you were at
7 Embry-Riddle?

8 A. There have been such a variety. We are a very
9 large aerospace aviation university. And essentially, I
10 was, even in the very early days, surrounded by a
11 variety of custom developed or modified quadrotors and
12 UAVs of all types. I don't recall specifically the
13 first one.

14 Q. And while at Embry-Riddle, did you do research
15 on quadrotor UAVs?

16 A. Yes, we did.

17 Q. And who funded the research?

18 A. I'm searching for a name. We helped to
19 develop it, a toy UAV, and I can't think of the name of
20 it that was externally funded. A lot of the research
21 probably was more to either set up a foundation for
22 research funding or for student competitions. I don't
23 recall direct support, external support. We had
24 internal university funding to work on a variety of
25 quadrotors, including the monocopter that I mentioned

1 earlier. I think we had external funding for that, but
2 I don't recall.

3 Q. And about what time frame did you work on the
4 toy UAV?

5 A. That would have been a little bit later, maybe
6 2012.

7 Q. And what was the approximate size of the toy
8 UAV?

9 A. It was rotors on the order of a few inches
10 rotor span.

11 Q. And what type of batteries would have been
12 used in the toy UAV?

13 A. I don't recall.

14 Q. And was the toy UAV ever sold commercially, to
15 your knowledge?

16 A. Well, the product that we developed, the
17 prototype, of course, wasn't sold. But the company did
18 manufacture and sell products that were based on the
19 work that we did.

20 Q. And you don't recall the name of the company?

21 A. I don't, I'm sorry.

22 Q. Now, the custom developed quadrotors that your
23 students worked on, were they documented in any papers?

24 A. You're asking specifically about the
25 quadrotors?

1 Q. Yes, the custom developed quadrotors you
2 mentioned.

3 A. I'd have to look -- well, I could look at my
4 own CV and tell you if there are any papers that came
5 out of that work. I don't recall without looking.

6 Q. Okay.

7 A. But there probably were papers that were
8 co-authored by students or colleagues. It was part of
9 the research that I was involved with that did discuss
10 some of the quadrotor work. I just don't recall.

11 Q. Would any of those students have written
12 thesis documents on the quadrotor design?

13 A. I think it's likely. Again, I can't
14 specifically recall.

15 Q. But those documents would be available in the
16 Embry-Riddle University library?

17 A. Probably.

18 Q. Now, did Embry-Riddle purchase any commercial
19 UAVs for you to use as a part of your classes or
20 research?

21 A. Yes.

22 Q. Which UAVs did the university purchase?

23 A. Probably a lot of what I mentioned was
24 purchased with university funding. So Parrot products,
25 there was a waterproof submersible quadrotor that may

1 have been called the Mariner or the Pelican. There's
2 probably such a variety, I just haven't done an
3 inventory on all of the things that were purchased and
4 used in research and teaching.

5 Q. And approximately, how much did the university
6 pay for the waterproof Mariner submersible UAV?

7 A. I need to qualify. I'm not sure that was the
8 name.

9 Q. That general product.

10 A. I would just be guessing. I would probably
11 say hundreds or a few thousand dollars. I don't recall.

12 Q. And did the university purchase any
13 Draganflyer products?

14 A. I don't recall.

15 Q. Did the university purchase any of the larger
16 UAVs, the six-rotor UAVs?

17 A. Again, I don't recall. Probably.

18 Q. And so I think you mentioned that you
19 eventually got into UAVs as a hobby; is that correct?

20 A. That's true, yes.

21 Q. And approximately, what time period would that
22 have been?

23 A. Probably about 2003 I started flying with
24 students. I didn't own my own hobby UAV, but I flew
25 with students who were pretty experienced pilots.

1 Q. And when did you first start to build your own
2 UAVs as a hobbyist?

3 A. I never built as a hobbyist. I designed and
4 built a UAV that I've flown.

5 Q. And when you said you got into UAVs as a
6 hobby, what did that entail?

7 A. It entails flying UAVs for pleasure.

8 Q. So you purchased your own UAVs?

9 A. I have, yes.

10 Q. And what was the first UAV that you purchased?

11 A. The only UAV that I've purchased for my own
12 use, at least the only significant one, I purchased a
13 number of the small indoor, inexpensive remote control
14 quadrotors and single rotor convention -- kind of
15 conventional UAVs for Christmas presents and other
16 things that I've flown.

17 But the only one that I've purchased, the only
18 large system I purchased, I probably got in 2015 maybe.
19 I don't know. I'd have to -- 2016.

20 Q. Okay. And what was that system?

21 A. It's a DJI Phantom.

22 Q. Which version of the Phantom?

23 A. It's a Phantom 3 Pro, I believe. That
24 probably would date it. I don't recall.

25 I've flown a number of others that aren't my

1 own personal ones. I have friends and students and
2 colleagues that fly. So it's a little hard to
3 recollect.

4 Q. So do you recall the larger systems, what your
5 friends were flying in the pre-2013 time frame?

6 A. A lot of fixed wing UAVs. So that's been
7 popular for 50 years, and I know people that have flown
8 for that long.

9 Q. Okay.

10 A. Rotary wing is more recent. A lot of the
11 students that I've flown with have custom developed and
12 built UAVs, or there have been UAVs that we have worked
13 on for research and we take them out and fly them. The
14 lines blur to me between a little bit between am I doing
15 it for work or is it for fun, which is a good thing, I
16 guess.

17 Q. Yes.

18 And I think in your CV, you mentioned that you
19 advised a team in the International Aerial Robotics
20 Competition in 2005. That would be page 4,
21 paragraph 12.

22 A. Right. Here, I think the mentions are to
23 particular successes when we won the competitions. I've
24 advised teams in these competitions since the early --
25 early 2000s in almost all of the ones I listed, if not

1 all of them.

2 Q. So the competition you mentioned, the
3 International Aerial Robotics Competition in 2005, what
4 type of vehicle did your team enter?

5 A. That was a Bergen Industrial Twin. That was
6 the primary vehicle.

7 Now, that competition required us to deploy a
8 sub vehicle from the primary vehicle. We experimented
9 with a variety of platforms for doing that.

10 But the primary vehicle was a Bergen
11 Industrial Twin in 2005.

12 Q. And that was, I think you said, was the
13 helicopter design, the Bergen?

14 A. Right. It's a more conventional, single-rotor
15 with a tail rotor helicopter.

16 Q. And in any of the competitions that you
17 mentioned in paragraph 12, did they involve a
18 multirotor, quadrotor, a four, six, eight rotor UAV?

19 A. Yes. Well, both the International Aerial
20 Robotics Competition, which I participated in on pretty
21 much an annual basis -- I think I have participated in
22 on an annual basis since at least 2004, and in the
23 Unmanned Aerial Systems Competition that I participated
24 in as an adviser was for about the same time period,
25 we've explored a number of different rotary wing UAVs

1 and probably six-rotor, although typically four-rotor.

2 The multicopter tend to be more suitable for
3 the first competition, the International Aerial Robotics
4 Competition. And the second competition, Unmanned
5 Aerial Systems Competition, is more favorable for fixed
6 wing UAVs.

7 But we've explored rotary wing UAVs and tested
8 some ideas for that competition as well, although we've
9 never competed with the rotary wing in that one.

10 Q. You said the system that won in 2007 in the
11 International Aerial Robotics Competition, was that a
12 multicopter UAV?

13 A. It wasn't. It was -- in 2007, it was the
14 Bergen Industrial Twin.

15 So I think I need to revise what I said
16 earlier. You're testing my memory. In 2005, I'm not
17 sure we flew the Bergen Industrial Twin in 2005. It may
18 have been, but I don't have a clear recollection of
19 that. We had a variety of platforms over the years.

20 Q. So you did mention that you did fly a
21 multicopter UAV in one of these competitions, correct?

22 A. Yes, that's correct.

23 Q. And who was the manufacturer of that
24 multicopter UAV?

25 A. Well, first, to clarify, there were a variety

1 of different platforms that we flew in the International
2 Aerial Robotics Competition, including flying the
3 monocopter in the competition that I mentioned before,
4 single-rotor, a variety of multirotors. And in many
5 cases, there was a particular platform that we flew at
6 the competition, but there were other platforms that
7 were tested and developed. Ultimately, refinement led
8 to entering a single platform, of course. So I can't
9 remember. But mostly they were either heavily modified
10 commercial products or custom developed UAVs.

11 Q. So the heavily modified commercial products,
12 what commercial products were you working with?

13 A. I don't have a clear recollection of the
14 systems that we purchased or the subcomponents that we
15 purchased for those.

16 Q. And when you say "we purchased," that was the
17 university purchasing --

18 A. Right. Well, I sign off on the purchase
19 requests.

20 Q. Okay.

21 A. It's not my money. It's typically -- although
22 I have purchased things for the university and for the
23 student teams, but mostly it's university funding, and I
24 sign off on the purchase request.

25 I should say, too, that the other competitions

1 also involve aerial vehicles. So the International --
2 I'm sorry, the student unmanned -- student -- the two
3 aerial ones are obvious. Obviously involve unmanned
4 aerial vehicles.

5 There's a competition called RoboBoat and
6 there is a competition called the Maritime RobotX
7 competition that also involve -- they have an aerial
8 component. They're primarily a surface vehicle
9 platform, but they have tasks that involve launching a
10 sub vehicle and recovering it.

11 Q. I have to ask questions about that because I'm
12 fascinated. So the RoboBoat competition could have a
13 UAV component, an aerial vehicle component. Can you
14 explain that?

15 A. I can, yes. So RoboBoat is a competition
16 supported by an organization called the Association for
17 Unmanned Vehicle Systems International. It's the big
18 umbrella organization in the unmanned systems, unmanned
19 and autonomous systems arena. And the RoboBoat
20 competition has been running since about 2005 maybe.
21 Maybe a little later than that.

22 The aerial component of it probably doesn't
23 specify -- it has to be a rotorcraft, but that is the --
24 the logical solution, I would say, and a more obvious
25 solution.

1 So in that competition, the boat has to
2 perform a number of tasks.

3 And to give a sense of size, the boat in that
4 competition is not big enough for a person to ride on.
5 The scale is less than 100 pounds, electrically
6 propelled. There is always a component of the
7 competition in recent years where the boat moves
8 autonomously to some area of the course where there is a
9 task or a target. For example, there may be a
10 collection of Alpha numeric characters that have been
11 put onto a dock that the boat itself is not tall enough
12 to see. And so without human intervention, the system
13 has to know that it's in the right place, deploy the
14 aerial vehicle, collect aerial imagery, interpret the
15 characters and report those back to a judge without
16 anybody on the team being involved in that aspect of the
17 competition.

18 Q. Okay. I understand.

19 So the boat has a small UAV as a component of
20 the boat?

21 A. On its deck, that's right.

22 Q. I think you mentioned that you signed off on
23 all of the purchases of the commercial UAVs for
24 Embry-Riddle; is that correct?

25 A. No. I didn't mean to imply that. For the

1 projects that I worked on, I've signed off on the
2 purchases.

3 In some cases, colleagues that work with me in
4 more recent years have signed off.

5 When I was department chair, I signed off on
6 everything.

7 Q. And that was 2007 to 2017?

8 A. That's correct.

9 Q. And what's the most expensive UAV that you
10 signed off on purchasing for the university?

11 A. I don't recall which one was the most
12 expensive.

13 Q. So what was the most you paid for a UAV at the
14 university?

15 A. You're asking, again, what -- well, I don't
16 know the answer to that. The university certainly has
17 some very expensive UAV systems. What I -- I don't know
18 the number.

19 Q. So let's start with the most expensive or the
20 most you signed off for paying for a UAV while you were
21 department head.

22 A. Department chair.

23 Q. Department chair, I'm sorry.

24 A. I would say -- I don't recall.

25 Q. Was it more than \$10,000?

1 A. I don't recall.

2 Q. Would it be common to pay more than \$10,000
3 for a commercial UAV?

4 A. We wouldn't commonly make a -- it wouldn't be
5 a routine purchase at the university. But it's commonly
6 available in that price range.

7 Q. And when you say it's commonly available, that
8 was in the 2007 to 2013 time frame?

9 A. Well, the Yamaha R-MAX, for example, is at
10 least a \$50,000, probably \$100,000 UAV. And that's been
11 available since perhaps 2005.

12 Q. And what was a routine purchase price for a
13 quadrotor UAV?

14 MR. ABRAMIC: Objection to form.

15 THE WITNESS: I don't have a number for what
16 would be routine.

17 BY MS. GORDON:

18 Q. Okay. What's your recollection of purchase
19 prices -- strike that. Let me try it again.

20 Do you recall what quadrotor UAVs cost in the
21 early days, in the early 2000s to 2010?

22 MR. ABRAMIC: Objection to form.

23 THE WITNESS: Well, again, most of our
24 systems, most of the quadrotor systems that we
25 developed, were custom. Developed in the expense

1 there is component by component, and some of those
2 were pretty expensive. I don't have numbers,
3 but...

4 BY MS. GORDON:

5 Q. Okay.

6 A. I can't give you a number for that, I'm sorry.

7 Q. And you said the university had some expensive
8 UAVs. What type of UAVs did the university purchase?

9 A. Embry-Riddle has a whole program in training
10 pilots for UAV operations.

11 Q. I see.

12 A. And so they have predators, simulators. If
13 they -- they have very expensive equipment. In some
14 cases, they have a wide variety of UAVs that they fly.

15 Q. Okay. So I understand. So you're laughing
16 just because your university operates with a really big
17 drone systems, correct?

18 A. Yeah, we operate from the tiniest, least
19 expensive to military grade UAVs.

20 Q. And so maybe I can focus my question more on
21 the quadcopter type UAVs. Did the university purchase
22 any expensive multirotor UAVs?

23 MR. ABRAMIC: Objection to form.

24 THE WITNESS: I'm sure they did, but we also
25 have, again, purchased -- we're a research

1 university, and a lot of the purchases are
2 components or customizing. And so it spans a very
3 wide gambit from vehicles that are designed to take
4 on multirotor vehicles that are designed to take
5 off and land vertically -- vertical, we say VTOL,
6 vertical takeoff and landing -- but then can
7 transition into horizontal flight with wings.

8 We have some systems that we've been
9 developing that are able to carry passengers. So
10 I'm sure those are very expensive. I don't have
11 numbers.

12 BY MS. GORDON:

13 Q. And did the university purchase any mid --
14 what I would call midsize quadcopters or multicopters
15 while you were department chair?

16 A. Could you define what you mean by "mid range"?

17 Q. So we've been talking about the hobby size
18 quadcopters, but my understanding is there is also
19 multirotor copters that are a bit larger that are used
20 by law enforcement and government agencies. Is that
21 understanding correct?

22 A. Well, the systems I've worked on span a range
23 from -- I mentioned rotor span because that's a pretty
24 good indicator of the weight. So we've worked on
25 systems that have rotor spans from an inch up to 10 feet

1 or maybe more than that.

2 And so I've tried to categorize them by being
3 midsize or even a hobby level. I tend not to think
4 about it in that way in my research.

5 Q. That's a fair point.

6 So the 10 feet or more quadrotors, who were
7 the primary manufacturers of those systems?

8 A. I believe those would be developed at the
9 university.

10 Q. Are there any commercial vendors of that size
11 of quadrotor?

12 A. I mentioned the R-MAX a few times. That's on
13 that order. It's a fairly large UAV.

14 Q. Is there any UAV that size or approximately
15 that size that would have six or eight-rotors?

16 A. I feel certain that there are. I can't name
17 one off the top of my head.

18 Q. What about -- we talked about 10 feet or more.
19 What would be the next bucket of systems you would say?
20 Would it be 5 to 8 feet or -- if we were categorizing
21 ranges of UAV, how would you categorize them if we were
22 talking about the span?

23 A. I wouldn't attempt to make a categorization.
24 I would describe -- if we were talking about a
25 particular system, I would try to describe that system.

1 Q. So in the range of, say, 5 to 9 feet, are
2 there any commercial vendors of quadcopters or six-rotor
3 UAVs?

4 A. What do you mean by "commercial vendor"?

5 Q. That would sell, for example, either to the
6 public or to the state and local government or police
7 departments.

8 A. You're asking in the range of 6 to 10-foot
9 rotor span?

10 Q. Yeah. I'm just trying to get a sense for what
11 products were offered at what size. So if we're
12 talking, you know, that size, were there any? And if
13 so, who was manufacturing them?

14 A. And you're asking quad or more, four or more
15 rotors?

16 Q. Yes.

17 A. I just don't know.

18 Q. Okay.

19 A. I'm not sure.

20 Q. If we took it to a smaller size, I think we
21 were talking six to ten. If we took it to four to six,
22 does that -- does your answer change?

23 A. A four -- a commercial vendor -- you're asking
24 me to -- if I can name a commercial vendor in what time
25 period?

1 Q. Let's start in the -- let's start from 2000 to
2 2013, that time frame.

3 A. There probably are. I can't name any off the
4 top of my head.

5 Q. In that time frame, can you name any
6 commercial vendors of quadcopters or multirotor copters,
7 like six or eight?

8 A. I haven't tried to categorize a time period.

9 Q. But if you had to name without bounding the
10 time period, who would be the biggest commercial vendors
11 of -- let's talk about the six or eight-rotor systems.

12 A. Six or eight-rotor systems are not that
13 common. And so I'm not sure who the major vendors of
14 those are. I'm guessing sales were pretty low of --

15 Q. Okay.

16 A. -- the systems.

17 Q. And then the quadcopters, who would you name
18 as the top commercial vendors there?

19 A. DJI has dominated the market in recent years.
20 That's the drone you typically see flying. But there
21 are a number of competitors that have good products that
22 are out there.

23 Q. And who are those competitors?

24 A. Autel, of course, is a competitor. There have
25 been the Go Pro products. It's just a state of quad

1 UAVs. I can't name all of the vendors. It's a rapidly
2 evolving market.

3 Q. So I want to turn to paragraph 3 of your
4 declaration which is on -- I'm sorry, paragraph 12, I'm
5 sorry, on page 4.

6 A. Okay.

7 Q. You say, "I have co-founded three successful
8 companies working in the area of robotics and unmanned
9 vehicle systems."

10 Do you see that?

11 A. I do.

12 Q. And what were those companies?

13 A. The first one I founded was a company called
14 New River Kinematics.

15 Q. Okay.

16 A. And that was in the early 2000s. They're
17 still doing quite well.

18 The second one was a company called Torc,
19 T-O-R-C, Robotics. And that was founded in the 2005
20 time period.

21 And as I think about it, maybe New River
22 Kinematics was founded a little before, maybe in the
23 late 1990s.

24 Both of those companies are still thriving.

25 The third company was a company called

1 Elevated Innovations. And they are no longer active,
2 but they had a couple of healthy research contracts.

3 Q. So let's start with New River Kinematics. Did
4 New River Kinematics develop any product?

5 A. They do have a number of products.

6 Q. And are any of those products multirotor UAVs?

7 A. I don't think so. I don't know today. I'm
8 not actively involved with the company. But in the time
9 period that I was involved and when I founded it, it was
10 not.

11 Q. And when you founded it, what was the focus of
12 the company?

13 A. The focus at that time was on manipulator arms
14 and very high precision, high dexterity work in
15 environments like nuclear service and also in the area
16 of metrology, taking precision measurements.

17 Q. So that was primarily land robots?

18 A. Robots that typically had a fixed base was the
19 early focus. That's probably true.

20 Q. And in the time period you were with Torc
21 Robotics, did that company develop any product?

22 A. Yes.

23 Q. What were those products?

24 A. Torc has sold a variety of different software
25 products, as has New River Kinematics. They also sell

1 or did market a robot simulation software package called
2 RobotAssist. RobotAssist, all one word.

3 Q. Okay.

4 A. Torc also does software development. They
5 have worked on a wide variety of R&D products. That was
6 the company that was founded in part as a result of our
7 participation in the DARPA challenges, DARPA cross
8 desert and urban challenge races.

9 They had, for a time, a product that was a
10 drive-by wire version of a Ford Escape. They worked on
11 an assortment of instrument sensors, tools for use in
12 the unmanned systems arena.

13 Q. And what was your role at New River
14 Kinematics?

15 A. I was a founder and I was president or
16 co-president, co-owner.

17 Q. And what was the time period you were with New
18 River Kinematics?

19 A. Probably the late 1990s into the early 2000s.
20 But I don't have a specific recollection of the dates.

21 Q. What was your role at Torc Robotics?

22 A. Same role. I was a founder and co-owner of
23 the company.

24 Q. And what time period were you with Torc
25 Robotics?

1 A. That would have been from when it was founded
2 in about 2005 until 2007, sometime in late 2007.

3 Q. Okay. And going back to New Rivers
4 Kinematics, were you the only founder of that company?

5 A. No. I had two former students. Well, at the
6 time we founded it, they were PhD students.

7 Q. And what are their names?

8 A. Bob Salerno and Joe Caulkins.

9 C-A-U-L-K-I-N-S, Caulkins.

10 Q. And is Bob Salerno still with New River
11 Kinematics?

12 A. I can't say for certain today, but he has been
13 recently.

14 Q. Okay. And do you know whether Joe Caulkins is
15 still with New Rivers Kinematics?

16 A. It's New River, singular, New River
17 Kinematics.

18 I believe so.

19 Q. And going back to Torc Robotics, were you the
20 sole founder of Torc Robotics?

21 A. No. I also founded that with a colleague and
22 with a number of students at the time.

23 Q. And did Torc Robotics design any quadrotor UAV
24 products?

25 A. Not for commercial sale.

1 Q. But you did design some for research purposes?

2 A. I think we did dabble in quadrotor UAVs, but
3 there was never a product or research project that came
4 out of that.

5 Q. And then turning to the third company you
6 mentioned, Elevated Innovations Research; is that
7 correct?

8 A. I don't think we had the "research" tied to
9 it. The company name was simply Elevated Innovations.

10 Q. And what was your role at Elevated
11 Innovations?

12 A. Same kind of role. I was founder and
13 president.

14 Q. And were you the sole founder of Elevated
15 Innovations?

16 A. No. Again, that was with a group of students.

17 Q. What was the focus of Elevated Innovations?

18 A. That was a UAV-focused company.

19 Q. When you say it's UAV-focused, what do you
20 mean by that?

21 A. Unmanned aerial vehicle focus.

22 Q. So what was the particular focus?

23 A. Broadly interest in unmanned aerial vehicles.
24 We had research contracts with Boeing. We developed
25 rotorcraft and we developed fixed wing UAVs.

1 There was a very high interest at that point
2 in time on 3-D printing. And so a component of that
3 work, an important component, was the ability to 3-D
4 print both the bodies of the UAVs but also other
5 components, including trying to develop some ability to
6 print electronics.

7 Q. And what time period were you with Elevated
8 Innovations?

9 A. I don't have precise dates for any of these,
10 but perhaps in the 2010, 2014 time period.

11 Q. Okay. And did Elevated Innovations
12 commercialize any of the rotorcraft that you worked on?

13 A. No. Those were -- at least the work that the
14 company did, the company did not sell commercial
15 products.

16 Q. Okay.

17 A. There may have been -- in all of these, there
18 may have been research that led to commercial products,
19 but we did not manufacture them.

20 Q. And do you know if any of the research the
21 company did in the multirotor UAVs led to a commercial
22 product?

23 A. I don't.

24 Q. And when you say there was research in
25 multirotor, was that quadrotor or larger?

1 A. Well --

2 Q. Or more rotors?

3 A. Okay. More in number of rotors?

4 Q. Yes, more in number of rotors.

5 A. The interest was broadly in UAVs and so it
6 went from single-rotor rotary craft. I'm sure we were
7 interested in more than one rotor. Four or six are
8 probably common arrangements.

9 Q. And do you recall whether Elevated Innovations
10 designed any quadrotor crafts?

11 A. We definitely worked on quadrotor aircraft,
12 yes.

13 Q. And on those crafts that you worked on, do you
14 recall how the rotor blades were coupled to the drive
15 shafts in those crafts?

16 A. I can't specifically recall one particular
17 example in the fastening method, no.

18 Q. Do you recall any example of the fastening
19 methods that were used by Elevated Innovations for the
20 quadrotor crafts you were working on?

21 A. I have trouble -- my experience is so broad on
22 having worked on so many projects with multirotor
23 aircraft and fixed wing aircraft, I have trouble
24 discerning what would be considered to be something I
25 did with Elevated Innovations or what I did with my

1 research or in student projects. They're broadly in
2 some well known ways of attaching rotor blades. I can't
3 specifically point to one product or one -- research as
4 in involving activity. And so in many cases, what we
5 have today is not the same system we have a month from
6 today.

7 And so I don't recall a specific example.
8 Probably, there were several ways we attached rotors.

9 Q. And when you -- just from a terminology
10 perspective, when you use the terminology "attached
11 rotors," what do you mean by attaching a rotor? What
12 does that entail?

13 A. Typically, it would be desirable to have the
14 rotor that stayed attached and was serviceable inflight
15 for any aircraft of any type that you produced.

16 Q. But I'm mostly focused on your use of the word
17 "attach." What does it mean to attach a blade to the
18 aircraft?

19 A. Well, I think it -- a blade could be attached
20 in some way. But if you're going to fly an aircraft,
21 then you'd like to have the blade attached in a
22 substantial way. You could lock it on. There are
23 designs such as the Prop Saver that allows the blade to
24 come off of it, especially if it's in a strike,
25 something else.

1 But typically, we're talking about removing
2 the 6 degrees of freedom between the blade and the motor
3 that's driving it.

4 Q. So let me just -- so to make sure I'm clear,
5 when you say "attach," you mean removing the 6 degrees
6 of freedom between the blade and the motor that's
7 driving it?

8 A. I think if you remove all 6 degrees of
9 freedom, you've locked the blade on. I think a blade
10 could be attached on some less substantial way.

11 Q. So in your view, locking is removing all
12 6 degrees of freedom, attaching is something less than
13 that?

14 A. I think a blade could be considered to be
15 attached and not fully locked on, yes.

16 Q. Okay.

17 A. That's a general comment, not just with the
18 rotor blade.

19 Q. Okay. Do you see any difference between the
20 terminology "attach" versus "installing" a rotor blade?

21 A. Are you asking me do I see a difference
22 between the word "installing" a rotor blade and
23 "attaching" a rotor blade?

24 Q. Yes.

25 A. They're similar. There could be differences

1 in the way, depending on -- as a hypothetical example,
2 if we took a particular case, install might mean
3 something slightly different than just attaching it to
4 somebody -- a mechanic, for example, working on the
5 aircraft.

6 Q. And can you explain a little bit more about
7 what that example would be where install would be
8 different than attach?

9 A. Well, in taking a hypothetical example, if I
10 said I was going to install a new engine in my car, I
11 think it might imply in that example a more
12 sophisticated operation than simply attaching an engine
13 to my car.

14 Q. Okay. And what more would that entail?

15 MR. ABRAMIC: Objection to form.

16 THE WITNESS: Well, in the hypothetical,
17 installing -- I haven't really thought about this;
18 there might be other examples. But a mechanic
19 installing an engine could perceive that to be a
20 more complex procedure -- maybe not in all cases --
21 than just attaching something. I think it depends
22 a lot on the context of the example.

23 BY MS. GORDON:

24 Q. I see folks use the terminology "mounting a
25 rotor blade onto the drive shaft." And what's your

1 understanding when somebody uses the term "mounting a
2 rotor blade" to mean?

3 A. I think it depends on the context and the
4 individual. It could mean attaching.

5 Q. Okay. And what would, in your view, what --
6 strike that. Let me try to ask that again.

7 What context differences would change the
8 meaning of mounting?

9 A. With that hypothetical, it would depend on the
10 example.

11 Q. So you would think mounting a rotor blade
12 would have different context?

13 MR. ABRAMIC: Objection to form.

14 BY MS. GORDON:

15 Q. If you're mounting a rotor blade onto a drive
16 shaft, what different context could there be?

17 A. Are you asking if we restrict this to a UAV
18 and in some way making a connection between the rotor
19 and the motor that's driving it?

20 Q. Yes. Let's start there. Let's restrict this
21 to a UAV and the connection between the rotor and the
22 motor that's driving it.

23 A. A mount may -- I'm not even sure at this point
24 what words we're comparing. Comparing what to what?

25 Q. So I just want to understand your

1 understanding of the terminology "mounting a rotor to
2 the motor" in the UAV context.

3 A. Well, mounting would be probably in some way
4 attaching it.

5 Q. Okay.

6 A. It could be locking it.

7 Q. Okay. And when could it be locking it?

8 A. Locking implies removing all 6 degrees of
9 freedom.

10 Q. So when you mount a rotor to a motor that
11 removes 6 degrees of freedom, you would consider that to
12 be equivalent to locking it?

13 A. I think if you asked me to mount a rotor blade
14 to a motor in such a way that removed all 6 degrees of
15 freedom, then I think that would be -- that rotor blade
16 would be locked onto the motor.

17 Q. And if mounting resulted in a system where not
18 all 6 degrees of freedom were removed, you would
19 consider mounting to be attaching?

20 A. I think it depends on the context.

21 Q. And how would it depend on the context?

22 A. Well, it would depend on if I asked somebody
23 to mount a blade, their understanding of what that
24 meant.

25 Q. So if someone -- if you asked someone to mount

1 a blade, what would you expect them to do?

2 A. I think it would depend on the context.

3 Q. So what aspects of the context would impact
4 your answer?

5 A. Well, we could ask somebody to mount a horse.
6 And so straddling a blade could be considered mounting
7 it, for example.

8 Q. So let me ask the question. So if you asked
9 someone to mount a blade on a motor in a UAV, what would
10 you expect them to do?

11 A. We could expect them to attempt to attach it
12 in some way, maybe lock it.

13 Q. So one last question about your background.
14 While you were working at these three companies you
15 mentioned, were you also employed by Embry-Riddle
16 University?

17 A. It's Embry-Riddle Aeronautical University.

18 Q. I'm sorry.

19 A. But that's fine. The university would want to
20 hear the full name.

21 Q. Okay. That's fair.

22 A. I was employed either at Virginia Tech or at
23 Embry-Riddle.

24 Q. Okay.

25 A. And you can shorthand it to Embry-Riddle if

1 that's easier.

2 Q. Okay. But not Embry-Riddle University?

3 A. They don't like that. I'm okay with it. It's
4 just to clarify.

5 Q. I understand. My alma mater is the same way.

6 A. Yes, they're particular sometimes.

7 MS. GORDON: Yes. So I think we've been going
8 for over an hour. Let's take a short break if
9 that's okay.

10 MR. ABRAMIC: Yep, sounds good.

11 (A recess was taken.)

12 BY MS. GORDON:

13 Q. So Dr. Reinholtz, I'd like to turn your
14 attention to the '184 patent. And probably keep your
15 declaration in front of you as well in case we turn back
16 to that.

17 A. Okay.

18 Q. So could you please turn to Drawing Sheet 2 of
19 the '184 patent?

20 A. Okay. I'm there.

21 Q. Okay. And Drawing Sheet 2 includes seven
22 figures labeled Figures 4 through 10, correct?

23 A. That's correct.

24 Q. And these figures are intended to illustrate
25 the operation of an exemplary lock mechanism, correct?

1 A. In general, yes. How not to install, I think
2 as well.

3 Q. So these figures are intended to illustrate
4 the concept that the clockwise rotor blade is engageable
5 only with the clockwise mechanism and cannot be engaged
6 in the counterclockwise mechanism, correct?

7 A. Generally, they help to illustrate that in
8 this embodiment, that's right.

9 Q. And the reverse would be true: They're also
10 intending to illustrate the concept of engaging the
11 counterclockwise rotor blade in the clockwise in the --
12 the counterclockwise mechanism, correct?

13 A. That's correct.

14 Q. Okay. So let's start by looking at Figure 4.

15 A. Okay.

16 Q. And do you see the center component of the
17 rotor blade? It's a raised -- a component, it's
18 unlabeled.

19 A. I do see the raised component, yes.

20 Q. And the protrusions on the raised component
21 that are labeled 25 are referred to in the specification
22 as lugs, correct?

23 A. I think it's correct that 25A and 25B refer to
24 lugs. I see 25A in Column 4, lugs 25A on blade lock
25 portion 17A.

1 Q. Okay. And in Figure 4, the lugs are just
2 labeled 25, correct?

3 A. There's a leader that points to one of the
4 lugs, or generally to that area, and it's labeled 25.

5 Q. Okay. And the indents labeled 27 on the drive
6 shaft in Figure 4 refer to, in a specification, as
7 notches, correct?

8 A. 27A is a notch, for example. Notch is 27A.

9 Q. But in Figure 4, it just is labeling the notch
10 with 27, correct?

11 A. There's a leader that goes generally to the
12 area of the notch that says 27, that's right.

13 Q. And in Figure 4, we see that the rotor blade
14 has been placed into a recess in the drive shaft,
15 correct?

16 A. I think that's generally correct.

17 Q. And in Figure 4, what does the capital R refer
18 to?

19 A. R is showing the direction of rotation to
20 cause the blade to lock into place. Let me see if I can
21 find the call-out to that.

22 In Column 4, the fourth line, it says, "Blade
23 9A is then rotated in direction R opposite to the
24 direction of the arrows."

25 The arrows are what's indicating how the rotor

1 spins.

2 Q. And so the arrows are the small arrow -- two
3 small arrows we see on the top of the drive shaft
4 component?

5 A. They're the same size or maybe even a little
6 heavier than the arrow that's associated with R. But
7 the arrows on top of that portion associated with the
8 shaft are -- yeah, those are the two arrows that show
9 the direction of rotation of the blade and operation of
10 the whole rotor in operation.

11 Q. And maybe you can help me with the terminology
12 because the specification talks about rotor blades. You
13 just mentioned rotors. When you use the term "rotor,"
14 what do you mean?

15 A. I think it's probably helpful to say "blade"
16 or "rotor blade." The terminology is sometimes a little
17 imprecise here.

18 When I say "rotor," I'm usually talking about
19 the rotor blade or the prop. I may be careless about
20 that when I say the drive or the rotor assembly. That
21 would be really talking about the whole system of the
22 blade and the rotor attached. So I think we need to be
23 careful to distinguish what components we're talking
24 about.

25 Q. And when you use the term "motor," what do you

1 mean by the term "motor"?

2 A. Motor is the component that provides the
3 motive force to rotate the assembly.

4 Q. And what is included in the assembly that
5 you're referring to?

6 A. Well, the entire assembly could include -- it
7 at least includes -- if we're talking about the rotor
8 assembly, it could include at least the motor, somebody
9 to mount the motor probably; in this case the components
10 that perform the locking function for this embodiment.
11 So the blade lock portion and shaft lock portion and
12 then the blade, the rotor blade itself.

13 Q. And I think you used the term "drive shaft."

14 A. I may have. I don't recall my exact words.

15 Q. And when you use the terminology "drive
16 shaft," what does that typically refer to?

17 A. It depends on the context, of course. Here,
18 it has to do with a shaft that performs a driving
19 function so it causes a rotation.

20 Q. Okay. Thanks.

21 So if we look at Figure 5, that depicts the
22 mechanism after the rotor blade has been rotated in the
23 direction R, correct?

24 A. That's correct.

25 Q. But this figure doesn't indicate that the

1 motor is operational, that the motor is spinning?

2 A. I'm sorry, I don't understand your question.

3 Q. So this is just showing the system after the
4 blade has been rotated, but the UAV is not turned on?

5 A. Well, it's a static picture. I don't think we
6 can infer very much about what's going on with the UAV
7 from this.

8 Q. But there is no -- is there any indication in
9 this picture that the rotor blade is spinning?

10 A. In Figure 5, the rotor blade has been locked
11 into place with respects of the blade lock portion and
12 the shaft lock portion are engaged, and they're locked
13 into place. We can't say anything from just the figure
14 about what might be happening with the UAV at this point
15 in time.

16 Q. But when the UAV is operational and the rotor
17 blade is spinning, the drive shaft and the rotor blade
18 would be rotating in the clockwise direction in these
19 figures, correct? In Figure 5?

20 A. Right. Clockwise is viewed from above the
21 rotor, yes, that's correct.

22 Q. And when it's rotating in the clockwise
23 direction, the UAVs would be pushing against the
24 notches, correct -- I mean, the lugs would be pushing
25 against the notches, correct?

1 A. You confused me a little bit because you said
2 the UAV.

3 Q. I know. Let me start again.

4 So when the rotor blade is spinning in the
5 clockwise direction, the lugs would be asserting a force
6 against the inside surface of the notches, correct?

7 A. They certainly could be, yes.

8 Q. When you say "could be," what do you mean by
9 that?

10 A. It depends. So force depends on things like
11 accelerations. So whether there is force imparted
12 between two surfaces depends on -- of course we're
13 looking at a figure that is in a particular embodiment.
14 We don't have the physical device in front of us but it
15 depends on a lot of things.

16 Q. So what would happen if the rotor blade would
17 encounter a force that pushes it in the counterclockwise
18 direction?

19 A. It's a hypothetical question. I'd have to
20 know more about the details of the actual device and
21 what kind of forces would be pushing it.

22 Q. What type of details would you need?

23 A. Well, the magnitude of the force or the
24 resulting torque probably we'd need to know about the
25 details of the particular mechanism. Here, we just have

1 a schematic.

2 Q. So would there be a force -- strike that. Let
3 me ask again.

4 Could there be a force in the counterclockwise
5 direction that would dislodge the rotor blade from this
6 slot?

7 A. Okay. Now, when you ask slot, are you asking
8 about Slot 23?

9 Q. Correct.

10 A. I think it's possible that force could be
11 exerted, certainly. If the blade were rotated in the
12 opposite direction R in Figure 4 relative to the shaft
13 lock portion, it certainly could be removed from the
14 slot.

15 Q. So if the UAV was in operation and it
16 encountered a sufficient counterclockwise force, the
17 blade could be rotated in the opposite direction of R
18 such that it could be -- it could remove from the
19 system?

20 A. I don't know how it would encounter -- it's a
21 hypothetical question. I don't know how it would
22 encounter such a force.

23 Q. So how would you remove the blade when it's
24 mounted as shown in Figure 5?

25 A. Well, it wouldn't be in operation, I would

1 hope, when somebody was trying to remove it. But the
2 removal would be to hold the shaft lock portion
3 stationary and then to rotate the blade in the opposite
4 direction of R.

5 Q. So what would happen in the system of 5 if the
6 UAV encountered or struck an object which resulted in
7 the top cover of the slot being broken off?

8 A. It's a hypothetical. I'd have to see how much
9 of it was broken off and what -- or both slots for the
10 part of the shaft lock portion, are both of them broken
11 off and completely removed?

12 Q. So if you had a crash such that both of the
13 top portions were broken off, what would happen to the
14 blade if the motor was still rotating in a clockwise
15 direction?

16 A. It's hypothetical. If such a crash -- we
17 don't know the material properties, we only have the
18 schematics here of the embodiment. But very likely a
19 crash of that magnitude would disintegrate the rotor
20 blade itself. So it's hard for me to envision a
21 situation where somehow just the pieces that define the
22 slot are somehow just eliminated without a lot of other
23 things being damaged.

24 Q. But, again, we're talking hypothetical. So
25 hypothetically, if you had such an event where the top

1 of those components were damaged and removed, what would
2 happen to the rotor blade?

3 A. Such an event would almost certainly destroy
4 the rotor blade and probably the entire aircraft would
5 be badly damaged at that point.

6 Q. But in the hypothetical I'm talking about, the
7 rotor blades weren't destroyed; there was just a
8 catastrophic failure in these components. If those
9 components broke and the rotor blades were still
10 spinning, what would happen?

11 A. You'd have to define more clearly what is --
12 what's broken, just what portion you're talking about
13 being removed.

14 Q. So if we removed the top portion of both slots
15 that we see in Figure 5 and the rotor blade still
16 remained in place, what would happen to the rotor blade
17 if the drive shaft continued to rotate in the clockwise
18 direction?

19 A. I think what you're asking is if there was no
20 longer a slot on the shaft lock portion?

21 Q. If the top cap of the slot was no longer
22 there.

23 A. Well, then it wouldn't be a slot anymore, if
24 I'm interpreting your hypothetical question correctly.

25 Q. That is correct. So my question is, if there

1 is a crash or an event such that the top of the -- I'll
2 say the top cap of the slots were removed, what would
3 happen to the blade if the rotor mechanism was still
4 spinning?

5 A. It's hard for me to imagine any event that
6 would cause that precise of a dissection of this
7 component. I'm not sure what would happen. It would
8 depend on the forces that were applied.

9 Q. So in your opinion, the rotor blade would stay
10 attached to the drive shaft?

11 MR. ABRAMIC: Objection to form.

12 THE WITNESS: If the slots are eliminated by
13 removing all the material on the top that defines
14 the slot on either side, then I think it certainly
15 is a lot easier for the blade to become dislodged.
16 If there is a lift force that overcomes friction,
17 it's going to become -- certainly it wouldn't be
18 locked on there anymore.

19 BY MS. GORDON:

20 Q. So does the specification of the '184 patent
21 describe any material properties that it uses in the
22 blade or shaft lock portions?

23 A. I don't recall. I'd have to review the entire
24 specification to see if there is any discussion about
25 the materials.

1 Q. And does the '184 patent anywhere describe the
2 schematic or any details about the size or dimensions of
3 the shaft or the blade lock portions?

4 A. I don't see anything in the specification that
5 specifies a particular set of dimensions for these
6 components. I think we might be able to discern at
7 least some range of dimensions. But I'd have to study
8 this and the references that are cited here.

9 But there is nothing specific that I see that
10 specifies a dimension.

11 Q. And your review of the '184 patent, to answer
12 that question, going back to the question I asked about
13 the material properties, based on your review you just
14 did of the specification, does the '184 patent describe
15 any material properties that it uses in the blade or the
16 shaft lock portions?

17 MR. ABRAMIC: Asked and answered.

18 THE WITNESS: I don't see anything that
19 specifies, for example, a strength of material.

20 But there clearly -- the material has to have
21 properties that allow it to perform the functions
22 that are required in the claims and the
23 specification.

24 BY MS. GORDON:

25 Q. And if we look at Figure 7 of the '184 patent,

1 and I'll direct you to the specification discussion of
2 that which occurs in Column 4, lines 23 through 26, here
3 it states, "Figure 7 shows the blade lock portion 17C of
4 the counterclockwise rotor blade 9C successfully
5 installed in the shaft lock portion to form a
6 counterclockwise lock mechanism."

7 Do you see that?

8 A. I do.

9 Q. What's your understanding of the term
10 "successfully installed" as used in this section of the
11 '184 patent?

12 A. The passage you just read talks about the
13 blade lock portion 17C and the shaft lock portion 15C.

14 And so I think here, it's referring to, of
15 course, a particular embodiment, but I think it's saying
16 that components are locked together. It's been
17 installed and locked because it's got the required shaft
18 lock portion and blade lock portion. So here, I think
19 it's saying they're locked in place.

20 Q. So in your view, installed here means locked?

21 A. I don't think the inventor is intending to
22 define the word "installed" here. I think it's just a
23 description of how the components are locked together.

24 Q. So what would be an unsuccessful installation?

25 A. I think the patent describes some failures to

1 be able to install, for example, a clockwise blade and a
2 counterclockwise drive. So a clockwise blade in a
3 counterclockwise drive motor that couldn't be done
4 successfully.

5 Q. So a successful installation is putting the
6 clockwise blade into the clockwise shaft lock portion?

7 A. I think that's a requirement of being able to
8 install and lock the blades, the shaft lock portion and
9 blade lock portion together.

10 Q. So let's look at Figure 8. Figure 8 is
11 depicting a clockwise blade being inserted into the
12 recess of a counterclockwise drive shaft, correct?

13 A. Yes, that's correct.

14 Q. And in this figure, the blade has been rotated
15 in the direction R, correct?

16 A. There appears to be an attempt that's shown
17 partially -- it's hard to say. Perhaps.

18 Q. But we see it move from the vertical position
19 to an angled position, correct?

20 A. It's not in the vertical position.

21 Q. Right, which indicates that it's been rotated
22 in the direction R, correct?

23 A. I think it's fair to infer that it's rotated
24 slightly in that direction.

25 Q. And we see from Figure 8 that a portion of the

1 blade is in what's been labeled in other figures, Slot
2 23, correct?

3 A. I don't know that we can say that looking at
4 Figure 8.

5 Q. So in Figure 8, isn't there a portion of the
6 cap over the slot that the blade is under?

7 A. Since we only have the top view, it's not real
8 clear whether there is a slot there. The blade is
9 rotated, I agree with that.

10 Q. And it is under some structure, correct?

11 A. I think the illustration does make it appear
12 that it's under at least a small corner of the top of
13 the shaft lock portion, but it's not clear.

14 Q. But if you look at, for example, Figure 4,
15 does that help make it clearer where the slot is -- the
16 opening of the slot is actually under the corner of that
17 structure, correct?

18 A. Well, in Figure 4, I don't see anything under
19 a structure. The blade is, at least what I can see in
20 the figure, it's all visible.

21 Q. So do you see the structure with -- it has a
22 left and right portion with small arrows on top of it?

23 A. I do.

24 Q. And there is Slot 23, correct?

25 A. That's true, yes.

1 Q. And the opening of Slot 23 is interior to the
2 rotor blade, correct?

3 A. I don't know what you mean by the opening of
4 the slot is interior to the rotor blade.

5 Q. So how does that rotor blade we see in Figure
6 4 get moved to the position that we see in Figure 5?

7 A. It's rotated in the direction R and the blade
8 moves into the slot.

9 Q. And what are you defining as "the slot"?

10 A. The slot is defined as 23.

11 Q. And does the -- so to get the blade from the
12 position we see in Figure 4 to Figure 5, it has to --
13 there has to be an opening in that structure that we see
14 on the left and the right-hand side, correct?

15 A. There has to be a slot for the blade to be
16 able to move from its position in Figure 4 to its
17 position in Figure 5, that's true.

18 Q. So when we look at Figure 8, that slot would
19 be under what we see as the component with the small
20 arrows on, correct?

21 A. It could be. We can't tell from Figure 8
22 because there is no labeling of the slot.

23 Q. But from Figure 4, we see that the slot is
24 under the component with the small arrow on, correct?

25 A. That's true.

1 Q. So what we see here in Figure 8 is the blade
2 is underneath the structure with the small arrows,
3 correct?

4 A. A small portion of it appears to be in this
5 single view.

6 Q. In Figure 8, could the user turn the blade any
7 further in the direction of R?

8 A. I think we can't really tell just looking at
9 this single figure. I don't think there is any
10 discussion of whether it can be turned further.

11 Q. So based on what you can see in Figure 8, the
12 blade could potentially be moved further in the
13 direction of R?

14 A. Not necessarily. I think it depends on the
15 details of the geometry. It's a small figure.

16 But clearly, there is interference that's
17 occurring that will prevent the blade from being fully
18 installed.

19 Q. And in the depiction we see in Figure 8, are
20 the lugs on the center portion of the rotor blade in the
21 notches that are on the drive shaft?

22 A. Part of the material that helps to define the
23 lug is in part of what might be considered a notch
24 there, what is a notch.

25 Q. So it's fair to say that the lugs are not --

1 are partially in the notches, but not fully received in
2 the notches?

3 A. I'm not sure I would say it that way.

4 Q. How would you say it?

5 A. I would say that Figure 8 is illustrating that
6 a blade can't be misinstalled.

7 Q. Would you say that the lugs are not fully
8 received in the notches in Figure 8?

9 A. I would say they're not fully received in the
10 notches.

11 Q. And is there anything in the '184 patent that
12 would prevent the user from starting the UAV with the
13 blade inserted as shown in Figure 8?

14 A. Well, that's a hypothetical question about a
15 user and a UAV. This is illustrating how the geometry
16 of the shaft lock portion and the blade lock portion
17 prevent misinstallation of the blade. There is no
18 discussion that I recall about how a user would attempt
19 to operate this.

20 Q. But a user could turn on the UAV after placing
21 the blade into the shaft lock portion in the manner we
22 see in Figure 8?

23 A. I think the user could turn on the UAV at any
24 point in time. I don't think there is anything in the
25 patent that prevents that.

1 Q. So the UAV could operate with the blade placed
2 in the manner we see in Figure 8?

3 A. What do you mean by "operate"?

4 Q. You could turn it on and the UAV, the rotor --
5 the motors would start rotating the blades?

6 A. Perhaps. It depends.

7 Q. So you're saying that the UAV in the '184
8 patent wouldn't turn on if the blades were installed in
9 the way we see in Figure 8?

10 A. No, I didn't mean to say that.

11 Q. So the UAV could be turned on? The power
12 could be applied?

13 A. It depends on the UAV, yes, I think so.

14 Q. And the motors would start then spinning the
15 drive shaft if the user gave it that command, correct?

16 A. It's certainly possible.

17 Q. All right. So I want to go back to Figure 5
18 for -- Figure 4 and 5 for a second. So we talked about
19 this being a -- what the specification calls a correct
20 installation, correct?

21 A. Are you citing to some place in the
22 specification?

23 Q. We spoke about Column 4, lines 23 through 26,
24 which relates to Figure 7, which is the counterclockwise
25 version of what we see in Figure 4 and 5.

1 A. Figure 7 shows the blade lock portion and the
2 shaft lock portion. It says, "Successfully installed to
3 form counterclockwise lock mechanism."

4 Q. And what we see in Figure 4 and 5 is the
5 clockwise blade being inserted and rotated into the
6 clockwise shaft lock portion, correct?

7 A. That's generally correct, yes.

8 Q. So does the '184 patent have any other
9 mechanism other than rotating it into the slot to hold
10 the blade in place?

11 A. I don't think the '184 patent, the claims
12 don't limit it to a particular configuration of the
13 slot.

14 Q. So if there were no slot, what would hold the
15 blades in place in the '184 patent?

16 A. Are you asking about this particular
17 embodiment that's illustrated in these figures?

18 Q. Well, the embodiment shows slots, correct?

19 A. It does show slots, 23.

20 Q. So if the '184 patent claims covering
21 embodiment without slots, simply the lugs and the
22 notches, how would the blade be secured in place?

23 MR. ABRAMIC: Objection to form.

24 THE WITNESS: Are you asking me to try to
25 develop an alternative that meets the claim

1 limitations?

2 BY MS. GORDON:

3 Q. I'm just trying to -- you raised the point
4 that Claim 1 doesn't require the slots. So is there any
5 embodiment in the '184 patent that would show that the
6 lugs and the notches by themselves would secure the
7 blade in the shaft lock portion?

8 MR. ABRAMIC: Objection to form.

9 THE WITNESS: The embodiment that's shown and
10 described uses the slots as well as the lugs and
11 notches. I see a different embodiment shown. It's
12 just an example.

13 BY MS. GORDON:

14 Q. But in your opinion, would the lug and the
15 notches by themselves be sufficient to keep the blade in
16 place during operation --

17 MR. ABRAMIC: Objection to form.

18 BY MS. GORDON:

19 Q. -- without the slots?

20 A. So you're asking me to analyze this particular
21 embodiment, the one that's shown in the figures on Sheet
22 2 and somehow eliminate part of what's shown and
23 described?

24 Q. Right. The part that you said wasn't required
25 by the claims.

1 A. I don't think I said that.

2 Q. You said it wasn't in the claims, correct?

3 A. What -- what was not in the claims?

4 Q. The slot.

5 A. No. The slot -- I don't think the claims
6 require the slot, that's true.

7 Q. So I'm just asking you to analyze what you
8 said was covered by the claims, which would simply be a
9 system with the lug and notch without the slot.

10 A. I don't think I said that.

11 Q. But you said the claims don't require a slot,
12 correct?

13 A. I said something to that effect, that's true.

14 Q. And there is no embodiment in the
15 specification that would cover a system without -- that
16 describes the system without a slot, correct?

17 A. I'd have to review the specification. The
18 figures we're looking at show a slot as part of the
19 shaft lock portion.

20 Q. And so let's focus on this embodiment that's
21 in this specification. So is there anything other than
22 the rotation into the slot that holds the blade in
23 place --

24 MR. ABRAMIC: Objection to form.

25 BY MS. GORDON:

1 Q. -- during operation?

2 A. Yes.

3 Q. Okay. And what is that?

4 A. Again, we're looking at line drawings of a
5 particular embodiment, but there are surfaces, faces
6 that interact that create the locking function between
7 the shaft lock portion and the blade lock portion.

8 Q. And what surfaces are you talking about?

9 A. Any place there's contact between the rigid
10 components, the structural components of the shaft lock
11 portion, and the blade lock portion will constrain
12 motion between the two and help to create a part of the
13 locking function.

14 Q. And that would include the contact between the
15 lugs and the notches?

16 A. Yes, it certainly could.

17 Q. And is that only when the drive shaft is
18 rotating that it would be constrained?

19 A. If there is no force attempting to create
20 relative motion, then nothing needs to be constrained,
21 so I'm really confused by your question.

22 Q. So you said -- so in your opinion, are the
23 blades locked when the UAV is not turned on?

24 A. If they're correctly installed, I think it
25 would be fair to say that they're in a locked

1 configuration.

2 Q. So are you making a distinction between being
3 locked and in a locked configuration?

4 A. I'm trying to answer the question you asked
5 about surface forces and constraints.

6 Q. Right. So I think your answer was -- let's
7 see. Let me go back.

8 So I was talking about what holds the blade in
9 place. And you said that it was -- let me read your
10 answer directly. "We're looking at a line drawing in a
11 particular embodiment, but there are surfaces, faces
12 that interact that create the locking function between
13 the shaft lock portion and blade lock portion," correct?
14 That was your answer?

15 A. I don't have it memorized, but I trust that
16 you read it correctly.

17 Q. Yes, okay.

18 So maybe we can take a step back and talk
19 about terminology. That may be why we're not
20 understanding each other right now. You talk about this
21 term "locking function." What do you mean when you say
22 a locking function?

23 A. Generally, I mean the shaft lock portion and
24 the blade lock portion have to interact to constrain all
25 6 degrees of freedom such that the blade can't have

1 relative motion relative to the driving motor, that it
2 rotates with the driving motor.

3 Q. So that's your definition of the term "locking
4 function" -- the "locking function"?

5 A. I think I'd have to think more. I wasn't
6 trying to provide a claim construction on the fly here.
7 I was just trying to generally answer your question.

8 Q. I think you used the term "locking function"
9 throughout the declaration, and we'll step through those
10 specific examples and maybe that will provide some
11 better context.

12 So in your answer there, when you used the
13 term "locking function," you were referring to the 6 --
14 constraining the 6 degrees of freedom such that the
15 blade can't have relative motion relative to the driving
16 motor?

17 A. Okay.

18 Q. I'm just asking, is that what you meant by
19 "locking function" in your answer, in your earlier
20 answer?

21 A. I think what I said was accurate.

22 Q. And I apologize, there's a lot of different
23 terms that are used to describe very similar things, so
24 I just want to make sure we're speaking the same
25 language here.

1 So going back to the lugs and notches that we
2 were talking about earlier, and you said that they --
3 the contact between the lugs and notches could constrain
4 or hold the blade in place, correct?

5 A. I don't recall saying that exactly.

6 Q. So you said -- let me go back. So you say
7 that there are surfaces that create the locking function
8 between the shaft lock portion and the blade lock
9 portion. And I asked you what surfaces you were talking
10 about. And you said any place there's contact between
11 the rigid components, structural components of the shaft
12 lock portion, and the blade lock portion will constrain
13 motion between the two and help to create a part of the
14 locking function.

15 And I said, "Would that include the contact
16 between the lugs and the notches?"

17 And you said, "Yes, it certainly could."

18 A. That all seems accurate.

19 Q. And so just for my purposes to clarify, the
20 contact between the lugs and the notches helps hold the
21 blade in place when the drive shaft is rotating?

22 A. They provide some constraint on the motion,
23 that's true.

24 Q. And how do they provide constraint on the
25 motion?

1 A. Motion is constrained by the interaction of
2 surfaces. So when one surface -- generally speaking,
3 when one surface begins to interfere with another, and
4 they're made out of relatively rigid material, then no
5 more motion can occur in the direction of the initial
6 motion.

7 Q. It's then because of the protrusion on the lug
8 hitting the indent in the notch that we see that
9 provides the constraint; is that correct?

10 A. Well, certainly when two surfaces contact,
11 there is a force then that tries to move them in the
12 direction of contact. Those surfaces constrain motion
13 and that can include the faces or surfaces of the
14 notches and the lugs, yes.

15 Q. So hypothetically, if the blade was in the
16 position we see in Figure 4 and it hasn't been rotated R
17 and the user would turn on the UAV and cause that drive
18 shaft to rotate in the clockwise direction, would that
19 blade stay in place?

20 A. It depends on the situation. More details
21 would be needed to determine that.

22 Q. Is there a situation where that blade would
23 remain in place if the drive shaft was rotating?

24 A. I think it's possible that if the drive shaft
25 is rotating very slowly and there are small forces, it

1 may not move. It's a hypothetical question.

2 Q. So if the user attempted a vertical takeoff
3 with the blade in the position you see in Figure 4,
4 would the blade remain in place?

5 A. Again, it's a hypothetical question. It would
6 not -- it would not remain in place. It would either --
7 I think it would either rotate partially into the slots,
8 but more likely it would fly off.

9 But again, we would have to see the details.
10 We may have to do an experiment to determine that.

11 Q. So is there anything that's -- maybe turn to
12 look at the claims for a minute. And the claims are in
13 Column 5 and 6 of the '184 patent.

14 A. Okay.

15 Q. And in this claim, it recites a rotary wing
16 aircraft, correct?

17 A. That's true.

18 Q. And do you see the second limitation where it
19 says the plurality of arms?

20 A. I do.

21 Q. What's your understanding of the meaning of
22 the term "plurality"?

23 A. I interpret that to mean more than one.

24 Q. Okay. So two or more?

25 A. I think that's correct.

1 Q. And is there anything in Claim 1 that
2 prevents -- strike that. Let me ask that again.

3 Does Claim 1 recite anywhere preventing
4 release of the blade when the drone crashes?

5 A. I'd have to read through the claim to see any
6 of those words in there. But I don't believe there is
7 any discussion about what happens when the drone crashes
8 in Claim 1.

9 Q. Is there any discussion of what happens when
10 the drone is operating?

11 A. Well, there is some discussions of things like
12 vertical lift force, which is obviously a reference to
13 operational forces.

14 Q. And that's what you're saying -- the vertical
15 lift forces are cited in line 51. Is that what you're
16 referring to?

17 A. It's recited at least twice, I believe. So if
18 you look at line 47, it talks about generating a
19 vertical lift force. And then again in line 51, it
20 talks about generating a vertical lift force.

21 Q. And let's look at the first recitation. What
22 does it mean for the clockwise rotor blade to generate a
23 vertical lift force?

24 A. I think the words take on their ordinary
25 meaning. Vertical means in the upward direction and

1 generating a force means that it creates a lift,
2 something that tries to pull the blade, and therefore,
3 if the rotor is locked on, then it should lift the --
4 generate a force, it attempts to lift the UAV as well.

5 Q. Is there any other type of lift force other
6 than a vertical lift force?

7 A. Lift implies that there is a component that's
8 vertical. I don't think it restricts the direction to
9 be purely, for example, in the direction of gravity. I
10 think as long as there is some vertical component.

11 So yes, I think there are variations on lift
12 force that can include forces that only have a component
13 in the vertical direction.

14 Q. So if we turn to -- let's keep Claim 1 out, if
15 you can, and let's turn to paragraph 53 of your
16 declaration where you're discussing the claim
17 construction for terms in this patent. Paragraph 53 is
18 on page 21, which is also Bates stamped 24.

19 If you can read paragraph 53 and let me know
20 when you've finished reading it.

21 A. Okay. I finished it.

22 Q. And in this paragraph, you state that the
23 locking function of the lock mechanism is accomplished
24 by the interaction of the shaft lock portion and the
25 blade lock portion.

1 Do you see that?

2 A. I do.

3 Q. What do you mean in this context by the term
4 "locking function"?

5 A. The locking function is, again, constraining
6 the relative motion between the blade and the motor that
7 drives it. So constraining the 6 degrees of freedom.

8 Q. And you state in this paragraph that, "It is
9 my opinion that a POSA would understand that the shaft
10 lock portion and the blade lock portion of the '184
11 patent must perform a locking function."

12 Do you see that?

13 A. I do.

14 Q. So in this statement, do you mean that the
15 shaft lock portion and the blade lock portion perform a
16 locking function together?

17 A. I'm confused by your question.

18 Q. I'm just trying to understand what you mean
19 here in this sentence. So can the shaft lock portion,
20 on its own, perform a locking function?

21 A. Perhaps in some hypothetical sense without --
22 with some other item. I don't know.

23 You're asking if there is no blade or no blade
24 lock portion?

25 Q. Yeah, I'm just trying to understand what you

1 mean by this sentence. So you say it is your opinion
2 that the shaft lock portion and the blade lock portion
3 must perform a locking function.

4 So when you wrote that, did you mean that
5 together they perform a blade lock -- a locking
6 function?

7 A. No, you didn't quote the material in the
8 declaration. You maybe paraphrased it.

9 But yes, the shaft lock portion and the blade
10 lock portion work together to perform a locking
11 function. I think the meaning is pretty clear.

12 Q. So does that mean then that you're not
13 intending to say that the shaft lock portion performs a
14 locking function?

15 A. No, I don't think I said that.

16 Q. So can you explain in more detail what you
17 mean by that sentence, because it's not 100 percent
18 clear to me.

19 A. Okay. I mean that the shaft lock portion
20 works with the blade lock portion, and together they
21 perform a locking function that constrains the 6 degrees
22 of freedom.

23 Q. So is there -- so does this construction cover
24 a case where the shaft lock portion performs a locking
25 function, and the blade lock portion provides --

1 performs a locking function?

2 MR. ABRAMIC: Objection to form.

3 THE WITNESS: They perform the locking
4 function together. They interact to perform a
5 locking function.

6 BY MS. GORDON:

7 Q. So they -- okay. So in the context of your
8 claim construction, the shaft lock portion and blade
9 lock portion are not performing a locking function in
10 isolation?

11 MR. ABRAMIC: Asked and answered.

12 THE WITNESS: Without -- if I have two
13 components that somehow are locked together and you
14 take away one of the components, you're asking me
15 if they're still a locking function? It seems like
16 an ambiguous question to me.

17 BY MS. GORDON:

18 Q. So aside from the shaft lock portion and blade
19 lock portion, does Claim 1 leave open the possibility of
20 any other component of a locking mechanism having a
21 locking function?

22 A. Could you repeat that question?

23 Q. Yes. Aside from the shaft lock portion and
24 blade lock portion, does Claim 1 leave open the
25 possibility of any other component of a locking

1 mechanism having a locking function?

2 A. I think your question seems to be drawing
3 together a locking function. I wasn't clear if you
4 meant that would be part of the already understood blade
5 lock portion and shaft lock portion. Are you talking
6 about something that's independent of those two?

7 Q. Independent of those two.

8 A. I think there could be redundant components
9 that may provide additional security. But I think the
10 blade lock portion and the shaft lock portion together
11 must perform a locking function.

12 Q. So we talked about your experience with
13 hobbyists and folks flying hobby drones, correct,
14 earlier today?

15 A. We talked a little bit about it, yes.

16 Q. And I suspect as part of that experience,
17 you've seen drones crash in a wide variety of different
18 ways throughout your experience?

19 A. That's true.

20 Q. And can you give me kind of a sampling of some
21 of the most interesting crashes you may have seen in
22 your drone career?

23 A. Most crashes -- well, crashes occur in varying
24 degrees. I've seen some catastrophic crashes where the
25 drone is completely destroyed. It generally -- of

1 course, the crashes are usually with the ground, and
2 they usually occur most frequently in takeoff and
3 landing. That's when the drone is most vulnerable,
4 although I've seen midair failures as well.

5 Q. And what type of midair failures have you
6 seen?

7 A. I've seen loss of power where the drone
8 becomes -- especially in a rotorcraft, the drone becomes
9 ballistic. It's under the influence of gravity and
10 rapidly crashes.

11 Q. And have you seen any in-air strikes where the
12 drone strikes an object while flying?

13 A. Other than the ground or somebody's finger, I
14 don't think so. I'd have to retch my memory, but I
15 don't think so.

16 Q. So I have to ask about the finger. So when
17 you say a strike involving a finger, somebody just puts
18 their finger in the way of the blade?

19 A. Not intentionally. That happened on a -- it
20 was a fixed wing UAV and many of the smaller fixed wing
21 UAVs are hand launched, meaning a person provides the
22 propulsion to achieve a speed above the stall speeds so
23 the plane can take off. And there was a poor throw, an
24 attempt to throw the UAV into the air, and the UAV
25 stalled but the propeller was still spinning. And it

1 pretty badly injured one finger on one student's hand.

2 I was not there, though, when it occurred, I
3 have to say. So I said I see it, it's vivid in my mind,
4 but I wasn't present when the accident occurred.

5 MS. GORDON: So I think we're about to move on
6 to the prior arts so it might be a good time to
7 take a five-minute break.

8 MR. ABRAMIC: Sure.

9 THE WITNESS: Great.

10 (A recess was taken.)

11 BY MS. GORDON:

12 Q. Dr. Reinholtz, I'm going to hand you what's
13 been marked as Exhibit 1004 to the '184 proceeding.
14 It's entitled "The User Manual md4-200 Version 2.2."

15 A. Okay.

16 Q. Are you familiar with this document?

17 A. I am.

18 Q. And did you review this document in
19 preparation for today's deposition?

20 A. I did not. I reviewed it prior to the trial
21 at the International Trade Commission, but not since
22 then.

23 Q. When you say "the trial," do you mean the
24 hearing?

25 A. Yeah, the hearing. Thank you.

1 Q. And that was just a few weeks ago?

2 A. It was -- that's a great question -- three
3 weeks ago, three or four weeks ago.

4 Q. But it was recently --

5 A. It was recent.

6 Q. -- that you reviewed it?

7 A. It was fairly recent.

8 Q. So you're familiar with the contents?

9 A. Generally so, yes.

10 Q. And before being retained to work in this
11 matter, were you familiar with the Microdrones product?

12 A. I've seen so many of this class of UAV in both
13 experimental and modified commercial limitations, I'm
14 just not sure. I may have. It looks familiar to me. I
15 couldn't have looked at a picture of it and named it as
16 Microdrones.

17 Q. I understand. Thank you.

18 So let's turn to page 27 of the Microdrones
19 manual. So 27 of the manual itself, which is Bates
20 stamped 37 at the bottom.

21 A. You're doing very well with that. I have it.

22 Q. I'm sure you're familiar with this page from
23 the ITC trial.

24 So if you want to turn in your declaration
25 pages 22 through 27, in case you want to refer that,

1 that's where you talk about the Microdrones product.

2 So looking at the manual itself, we see the
3 first paragraph on the right says that the md4-200
4 operates four rotors, two of which turn clockwise and
5 the other two counterclockwise.

6 In this portion, Microdrones is using the term
7 "rotor" to refer to the rotor blade, correct?

8 A. Well, certainly the blades do turn in those
9 directions. It looks like from the context of the
10 paragraph, they are specifically talking about the rotor
11 blade here, I think, yes.

12 Q. Okay. Thank you.

13 And in this paragraph, Microdrones is
14 describing clockwise and counterclockwise rotor blades,
15 correct?

16 A. That's correct.

17 Q. And the paragraph continues that each rotor
18 has two knobs on its bottom of the center bar. Do you
19 see that?

20 A. I do.

21 Q. And are these the two protrusions we see on
22 the bottom of the blade in the top picture on the
23 left-hand side of page 27?

24 A. They're small, but yes, you can see them
25 there.

1 Q. And would these knobs be considered to be
2 lugs?

3 A. I think in some context, they could be.

4 Q. And the manual continues by saying that each
5 of the two knobs are matched by two holds on the rotor
6 mounting blade. Do you see that in the first paragraph?

7 A. Yes, I do.

8 Q. And the holds that Microdrones is referring to
9 are the two circular indentations that we see on the
10 silver mounting plate in the top image, correct?

11 A. They're certainly referring to indentations or
12 openings in that top blade. I can't tell that it's
13 silver. It's whitish-silver. But I think we're talking
14 about the same thing, yes.

15 Q. And those indentations are notches, correct?

16 A. They could be considered notches, yes.

17 Q. So in the next paragraph, the manual states
18 that to avoid accidental misplacement, both directions
19 of turning use individual distances between the knobs.

20 So in this paragraph, Microdrones is
21 explaining that the clockwise rotor blade has a first
22 distance between knobs, and the counterclockwise rotor
23 blade uses a different distance between knobs, correct?

24 A. It doesn't say all that. It just says the
25 distances, these individual distances. You'd have to

1 infer that.

2 Q. But that's fair to infer, correct, in this
3 statement?

4 A. There is certainly some difference in spacing
5 of the knobs, yes.

6 Q. And when they say both directions of turning,
7 they're talking about the clockwise and the
8 counterclockwise blades, correct?

9 A. That's correct.

10 Q. And when they use the term "direction of
11 turning," what's your understanding of that phrase in
12 the context of the second paragraph?

13 A. It seems pretty clear they're talking about
14 two of the blades rotate clockwise. That's one
15 direction of turning. And two, rotate counterclockwise,
16 that's the other direction of turning.

17 Q. And the different configurations of knobs on
18 the counterclockwise and the clockwise direction are
19 designed so that the user does not accidentally place
20 the clockwise rotor blade on the counterclockwise drive
21 shaft, correct?

22 A. Well, it's intending to help avoid that.

23 Q. And this is what people generally refer to as
24 mistake proofing?

25 A. No. This is mistake avoiding, I would say.

1 Q. Mistake avoiding? Avoiding accidental
2 misplacement?

3 A. That's correct.

4 Q. So in the next paragraph, paragraph 3, it
5 states that when mounting the rotors, the motors must be
6 supported by one finger being pushed inside the bottom
7 hole of the motor pod.

8 So what is the motor pod in figure -- on the
9 left, in the top figure on the left?

10 A. The reference is to the part of the rotor
11 assembly that supports the motor. So what looks like a
12 carbon fiber material -- I think when they're saying
13 "pod," they're talking about probably that whole
14 structure of the motor and what encloses it or what
15 constrains it, captures it.

16 Q. And then it continues that if you press too
17 hard from the top without support, the risk is to press
18 the motor frame out of the carbon fiber reinforced
19 plastic CFRP pod.

20 A. Yes, that's right.

21 Q. So in this paragraph, Microdrones is
22 indicating that when the user is mounting the rotor,
23 there is a force applied in the downward direction
24 against the motor, correct?

25 A. It's cautioning that if you press from the

1 top, too hard from the top, then you can press the motor
2 frame out of the carbon fiber pod.

3 Q. And so the implication here is that they
4 intend for the user to be pressing from the top downward
5 on the motor when mounting the blades, correct?

6 A. I don't know if they intend for that to be the
7 case. It certainly can happen, that you can exert a
8 downward force as you're trying to stretch the O-ring
9 around in particular.

10 Q. But the manual doesn't talk about installing
11 the O-ring until the next paragraph, correct?

12 A. Well, the discussion of the O-ring is in the
13 next paragraph. But of course this is warning that as
14 you do the installation, which includes -- it obviously
15 has to include the O-ring, you don't want to push too
16 hard and push the motor out of the pod.

17 Q. But it's possible it could also be referring
18 to pressing the knobs into the notches, correct?

19 A. I don't -- it doesn't say that. I don't see
20 that as an implication of this.

21 Q. But it shows this step occurring before the
22 user is attaching the O-rings, correct?

23 A. Well, I wouldn't describe it as a step. It
24 just says when mounting the motors -- rotors -- I'm
25 sorry, not motors -- when mounting the rotors, the

1 motors must be supported.

2 Q. So what's your understanding of mounting the
3 rotors in this context?

4 A. It says here it's just a general discussion
5 about attaching the rotors to the drive.

6 Q. And that's a two-step process by placing the
7 knobs in the indents and then attaching the O-rings?

8 A. At least those two steps are required.

9 Q. And the manual is concerned that the user is
10 going to -- could potentially apply too strong of a
11 force to the motor while doing this, correct?

12 A. I think it's fair to say during the full
13 installation process, it's a warning not to press down
14 too hard unless you support the motor from below.

15 Q. And going to the fourth paragraph, in the
16 second sentence, it says that the rotors are secured by
17 two O-rings of rubber.

18 A. Yes.

19 Q. And the third figure from the top on the left
20 shows one of those O-rings, correct?

21 A. I can't tell if that's showing one or both
22 having been installed. The third figure may be showing
23 two.

24 Q. Okay.

25 A. I'm not sure.

1 Q. But the O-rings would be installed side by
2 side?

3 A. Well, they're overlaying each other.

4 Q. And so this system uses two O-rings to secure
5 the blade to the mounting blade?

6 A. I think the intent -- I don't see it here.
7 Maybe I'm missing it. But the intent is to use two. I
8 know some people with this Prop Saver kind of a design,
9 use more than two.

10 See that it precludes using more than two?

11 Q. Uh-huh.

12 A. But I think two are shown here.

13 Q. And the manual mentions two O-rings?

14 A. Yes, that's right. Okay, it does.

15 Q. And it says that the rotors are secured by two
16 O-rings. And when it says "secured," it's referring to
17 securing the rotor to the mounting blade, correct?

18 A. Yes. And then of course to the motor that
19 drives the mounting blade.

20 Q. And then in the next paragraph, it states, "If
21 new rotors are used, ridges around the knobs may hinder
22 the correct fitting. In this case, use a fine file to
23 smooth in the ridges to make the rotors fit nicely."

24 Do you see that discussion?

25 A. I do.

1 Q. So if there are ridges around the knobs, that
2 would prevent the knobs from being fully inserted into
3 the indentations, correct?

4 A. Not necessarily.

5 Q. But it's possible that those ridges could
6 hinder the knobs from fitting into the notches?

7 A. It says it may hinder the correct fitting,
8 that's true.

9 Q. And isn't that what we see being depicted in
10 the fourth figure from the top and the left, is a
11 situation where the knobs are not fitting properly into
12 the corresponding notches?

13 A. I think that's a possible interpretation, but
14 the general discussion here is about misinstalling the
15 blade. And so I think this figure is clearly referring
16 to the case where a blade has been attached to the wrong
17 rotor. In other words, it's a -- in this case, a
18 counterclockwise rotating blade that's been attached to
19 a clockwise motor and why that's incorrect.

20 Q. So what about that figure, the fourth figure
21 from the top, tells you that it's a clockwise motor?

22 A. That can't be discerned, but the general
23 discussion here is about this very important topic of
24 avoiding possible misplacement of a rotor; in other
25 words, a clockwise rotor blade on a counterclockwise

1 motor, for example. That's the focus of the discussion.

2 There is a small discussion here about the
3 ridges, but I think the general discussion is focused on
4 this installation issue.

5 Q. So there's only one sentence about accidental
6 misplacement though, correct, on this page?

7 A. I think the page is generally talking about
8 assembling the rotors. That's the title of Section
9 2.1.2.2. And there's a discussion. The first paragraph
10 talks about the knobs and the holes. I think it's all
11 about correctly installing the blades.

12 Q. And one way that could be a problem is if the
13 knob had these ridges on it, correct?

14 A. It's an issue if the user doesn't follow the
15 instructions and remove the ridges, it could be.

16 Q. So if we look at that fourth figure and the
17 fifth figure underneath it, they both show
18 counterclockwise blades, correct?

19 A. That's true.

20 Q. And in one figure, the blade is raised, and
21 the other figure, it's flush with the mounting blade,
22 correct?

23 A. In the figure with the red X, it's slightly
24 raised. In the lower figure, it looks to be seated,
25 that's correct.

1 Q. And there's nothing in these figures that
2 would indicate the type of motor that counterclockwise
3 blade is attached to, correct?

4 A. There is no way to discern except to
5 understand that this series of figures is showing what
6 can happen when a blade is incorrectly installed on the
7 wrong motor.

8 Q. But it could also be showing a correctly
9 installed blade that had these ridges on it, correct?

10 A. I think that possibility can't be completely
11 dismissed, but it seems like that is not the main
12 concern here. The focus is clearly on properly
13 installing a rotor blade.

14 Q. But the figure that we see with the red X and
15 the figure with the green checkmark shows the same --
16 blades with the same directionality, correct, in both
17 photos?

18 A. Right, but on most certainly with motors that
19 are opposite.

20 Q. But there is nothing in the figure that would
21 say the motors are opposite?

22 A. You can't tell from the figures, but in a
23 person of ordinary skill in the art would understand
24 reading this material that this is about correctly
25 installing the rotor blades.

1 Q. You see in Figure 4, there's a red blotch on
2 that motor in the left, the bottom. Do you see it's
3 like a little red -- I don't know if you call it a
4 shadow or a red marking on that motor.

5 A. It might be reflective light. It's hard to
6 tell what that is in small figures.

7 Q. The same marking shows up on the motor below
8 it?

9 A. I wouldn't necessarily say that's the same
10 marking. It's the marking -- it's a similar reflection
11 or marking probably on the motor that turns in the
12 opposite direction.

13 Q. But you have -- there is no way for you to
14 know whether those are not the same motor, correct?

15 A. It can't be said with certainty that they're
16 not. But the logic would tell a person of ordinary
17 skill in the art that this is showing incorrect
18 installation and what happens in incorrect installation.

19 Q. But logic would also indicate that it could be
20 a depiction of, if you had ridges, what it would look
21 like?

22 A. I think if the manual is attempting to show
23 that, they would show a picture of blades with ridges to
24 show what that looked like. I think it's a possibility
25 the one you raise can't be completely eliminated. But

1 it seems like a much lower possibility that that would
2 be something that would be depicted.

3 Q. So is there anything about the motors we see
4 in those bottom two figures that indicates the direction
5 it spins?

6 A. Other than the general understanding of what
7 is being explained here, the important point of this
8 section, the figures themselves can't be discerned which
9 direction the motor spins.

10 Q. So if we look at the paragraph that starts at
11 the bottom of this page --

12 A. Yes.

13 Q. It says, "In case of an accident in which the
14 rotors have hit any obstacle, a thorough check of the
15 rotors is mandatory to avoid further mischief by
16 breaking during flight."

17 Do you see that sentence?

18 A. I do.

19 Q. Does that discussion of an accident mention
20 that the blades are designed to become released?

21 A. No. The sentence you read doesn't talk about
22 the blades releasing.

23 Q. So this paragraph also doesn't mention that
24 the O-rings release in the case of an accident, correct?

25 A. No. This is talking about damage to the

1 blades.

2 Q. So there is nothing in this section that
3 indicates that the O-rings are designed to release if
4 the UAV hits an obstacle?

5 A. There is nothing specifically described in
6 this section. But this is a common design called the
7 Prop Saver that is designed to be flexible enough that
8 it can bend and then release in case of a prop strike.

9 Q. But Microdrones doesn't call this mounting
10 mechanism a Prop Saver, does it?

11 A. The manual does not use those words.

12 Q. And there is nothing in the manual that says
13 the O-rings are designed to release if the UAV hits an
14 obstacle?

15 A. No. But a person of ordinary skill in the art
16 would understand that that's the intent of this
17 particular design.

18 Q. But I'm asking what the manual says. So the
19 manual doesn't call the O-rings "Prop Savers," correct?

20 A. It does not call O-rings "Prop Savers," that's
21 true.

22 Q. So I'm handing you what's been marked as
23 Exhibit 2002 to this proceeding.

24 A. Yes.

25 Q. And it's entitled -- well, "RC Plane Prop

1 Saver."

2 A. Yes.

3 MS. GORDON: Do you need a copy?

4 MR. ABRAMIC: Thank you.

5 BY MS. GORDON:

6 Q. Okay. Are you familiar with Exhibit 2002?

7 A. I am.

8 Q. Did you review this in preparation for today's
9 deposition?

10 A. I did not look specifically at this in the
11 last few days, but I've seen it multiple times. I found
12 it on the internet, and I've seen it before.

13 Q. And in your declaration, I believe you discuss
14 this in paragraph 29. If you want to turn to that
15 paragraph.

16 A. Okay. I'm there.

17 Q. You say that Exhibit 2002 discusses a Prop
18 Saver design, correct?

19 A. It is that, but are you reading from my
20 declaration or --

21 Q. Yeah. So paragraph 29, you say, "Another
22 blade attachment method commonly known as a Prop Saver
23 was well known to a POSA at the time of the invention,
24 although '184 patent" -- and you cite to Exhibit 2002,
25 which is the exhibit we have in front of you, correct?

1 A. That's correct.

2 Q. And so you are referring to the prop system
3 that's in 2002 was a Prop Saver?

4 A. The attachment method is known as a Prop
5 Saver, yes.

6 Q. And does 2002, the attachment mechanism in
7 2002, use knobs and holds for matching clockwise rotors
8 to clockwise drives?

9 A. There is no discussion in this of knobs and
10 holds, to my recollection.

11 Q. So I'm handing you what's been marked as
12 Exhibit 2004 to the '184 proceeding. It's U.S. Patent
13 9,677,564.

14 MR. ABRAMIC: Thank you.

15 BY MS. GORDON:

16 Q. Are you familiar with this patent?

17 A. I am.

18 Q. And did you review this patent in preparation
19 for today's deposition?

20 A. Not recently, but I have reviewed it in the
21 past.

22 Q. And you're familiar with this patent?

23 A. I don't have it memorized. It's a long
24 patent, but I'm generally familiar with it.

25 Q. So can you look at the front page of the

1 patent and the item that's labeled 22? Do you see that?

2 A. The front page?

3 Q. Yeah. It's a date associated with the term
4 "filed."

5 A. Oh, I'm sorry. Where are you looking?

6 Q. On the front page. It's an item labeled 22.

7 A. Yes, I have that.

8 Q. What's the filing date of this patent?

9 A. January 15, 2015.

10 Q. And if we turn to paragraph 38 of your
11 declaration, you state that the time of invention of the
12 '184 patent is assumed to be May 15, 2013, correct?

13 A. That's correct.

14 Q. So this patent was filed almost two years
15 after the relevant date of the '184 patent, correct?

16 A. That's true, yes.

17 Q. And did you personally find Exhibit 2004 when
18 preparing your declaration?

19 A. I can't recall. I know I looked at the
20 Microdrones and knew that was a Prop Saver and looked
21 for material. Whether I found this patent, I can't
22 recall.

23 Q. So you searched for Prop Saver references on
24 your own?

25 A. I did.

1 Q. But you were provided with Prop Saver
2 references from others?

3 A. I can't recall.

4 Q. You don't recall whether anybody provided
5 references for your review?

6 A. Well, in general, I know counsel has given me
7 references to consider. Whether this particular one
8 that we're talking about, the '564 patent, I don't
9 recall if I found that or if someone else suggested it
10 to me.

11 Q. And did you personally search for references
12 that predated May 15, 2013 for this Prop Saver function?

13 A. As I said earlier, I do recall searching the
14 internet and finding the Dave Smith blog that we were
15 just discussing, talking about Prop Savers being one of
16 them long before 2013. I don't --

17 So I did do searches. I would have, I'm sure,
18 taken note of dates on patents at some point in time.
19 But I was just generally searching for meaningful
20 references at that point.

21 Q. So if we look at paragraph 31 of your
22 declaration, which is I think providing a cite from this
23 '564 patent that we're discussing.

24 A. Yes.

25 Q. You provide a citation which states, "Another

1 existing safety feature is a Prop Saver," and then you
2 provide more of that quotation.

3 And you end the paragraph with the statement
4 that, "In my opinion, this description is consistent
5 with my understanding of a Prop Saver design and with
6 what a POSA would understand to be a Prop Saver design;"
7 is that correct?

8 A. That's correct.

9 Q. What is your understanding of a Prop Saver
10 design?

11 A. Prop Savers have been well known for probably
12 at least 20 years. The name is a little bit of a
13 misnomer in the sense that the intent is more to prevent
14 damage to the air vehicle than to the prop. Once a prop
15 strikes an object, typically we discard those. We
16 certainly check them at the very least, but typically we
17 assume that they're damaged. So the intent is really
18 more -- when there is an impact usually with the ground,
19 to minimize the amount of damage that occurs.

20 Q. Is it your opinion that every use of an O-ring
21 to attach a blade to a drive is a Prop Saver design?

22 A. I haven't seen any that aren't. There may be
23 a case that I haven't seen that it wouldn't be.

24 Q. So the use of O-rings doesn't imply that it's
25 always a Prop Saver?

1 A. I haven't seen any examples to indicate that
2 it wouldn't be. I'm saying there may be examples that I
3 don't know about.

4 Q. So in the '184 patent, the rotors would be
5 damaged if there was a strike?

6 A. I wouldn't focus on the patent to answer that
7 question. Generally, in an aircraft, if the prop
8 strikes an object, the assumption is that there is
9 damage, and we act from that point.

10 Q. So in the '184 patent, you would say that it
11 doesn't have a Prop Saver mechanism?

12 A. Well, Prop Saver is a known way to attach
13 rotor blades flexibly. And so clearly, the '184 patent
14 is not describing the Prop Saver. It would be known to
15 a person of skill in the art.

16 Q. So the '184 patent then would have an issue
17 that if it had a strike, the prop would be damaged?

18 A. As I tried to indicate, any prop strike would
19 likely damage a prop to the point where the user,
20 hobbyist, or person of skill in the art would replace
21 the blade, whether it detached with the Prop Saver or
22 not.

23 Q. Let me ask it a different way. In the '184
24 patent, the structure is that there would be more damage
25 to the UAV than the prop due to the way that the blades

1 are attached?

2 A. If there was a prop strike with the attachment
3 mechanism, locking mechanism, described in the '184
4 patent -- I thought this through. I think the UAV in
5 the event of a prop strike, it would be more vulnerable
6 than if the props were attached in a flexible way as
7 they would be with the Prop Saver. I think that's true.

8 Q. So when you say a "prop strike," what do you
9 mean by "a prop strike"?

10 A. When the propeller hits an object other than
11 air, that's a prop strike.

12 Q. So is there a circumstance where the propeller
13 could hit an object and if the -- let's talk about the
14 clockwise rotating propeller. Is there a circumstance
15 where the clockwise rotating propeller could hit an
16 object that would cause a counterclockwise force to be
17 applied to the propeller?

18 A. So if a blade is spinning clockwise --

19 Q. Yes.

20 A. -- then the force, if it strikes an object
21 that forces in the direction -- the forces in the
22 counterclockwise direction in that case.

23 Q. Why don't we put aside the '184 patent for
24 now.

25 I have a few questions for you on the '000 and

1 '013 patent.

2 A. Okay.

3 Q. So if you want to reconfigure your papers.

4 A. Okay. I'll set all the material aside that we
5 were just discussing, if that's okay.

6 Q. Yes. That's perfect.

7 So let's focus on the '000 declaration.

8 A. Okay.

9 Q. So I'm handing you what's been marked as
10 Exhibit 2010 to the PGR-014 proceeding. I believe it's
11 also been marked as an exhibit in the PGR-16 proceeding.

12 Are you familiar with this document?

13 A. Generally, yes.

14 Q. And this is the ITC claim construction order,
15 correct?

16 A. That appears to be correct, yes.

17 Q. And if you could keep that out and turn to
18 paragraphs 30 to 32 of the '000 declaration.

19 A. Okay.

20 Q. In these paragraphs, you're discussing the
21 level of skill in the art for the '000 patent, correct?

22 A. That's correct.

23 Q. And these paragraphs are substantially the
24 same as the paragraphs on level of skill in the art in
25 the '013 declaration, correct?

1 A. If not identical, substantially the same, I
2 believe, yes.

3 Q. So I'd like to talk about paragraph 31
4 specifically which refers to page 8 of the ITC document.

5 A. Is that page 8 on the document or the --

6 Q. I believe you were referring to Bate stamp
7 page 8, which is the document page 6.

8 A. Okay. I should have known that. That's my
9 reference.

10 Q. And in page 6 of the ITC document, this is
11 where the ITC is indicating what they've determined to
12 be the level of skill in the art for the three patents
13 at issue in that proceeding, the '174, the '184, and the
14 '013 patent, correct?

15 A. That's correct.

16 Q. So if we look at the level of skill in the art
17 for the '013 patent, this document says that a person of
18 ordinary skill in the art with respect to the '013
19 patent would have at least, one, a bachelor's degree in
20 mechanical engineering or equivalent knowledge, training
21 or experience; and two, at least two years of experience
22 with electromechanical systems or equivalent experience.

23 Do you see that?

24 A. I do.

25 Q. And that's different than what you propose to

1 be the level of skill in the art, correct?

2 A. It's a little different. The
3 electromechanical makes it just a little different, but
4 similar.

5 Q. And you say you believe that definition is
6 consistent with your opinions regarding a POSA?

7 A. Are you asking me if I think the ITC claim
8 construction order is consistent; that the discussion
9 there is consistent with my understanding?

10 Q. Yes. So you state that you believe that the
11 definition is consistent with your opinion in
12 paragraph 31.

13 A. Right, regarding this patent, yes. I think
14 it's consistent.

15 Q. And you would -- you have the same opinion
16 that it would be consistent with the '013 patent as
17 well?

18 A. That's correct.

19 Q. And why -- what are the reasons why you
20 believe that the definition is consistent?

21 A. They're pretty similar. They both -- the
22 fundamental requirement is a bachelor's degree in
23 mechanical engineering. So that's probably the most
24 significant. We both -- both definitions, mine and the
25 one provided by the court, talk about experience.

1 The electromechanical implies that the --
2 there's an electrical aspect to this, which there could
3 be with a battery, so I don't completely disagree with
4 that, but I think the mechanical aspects are more
5 significant with the battery latching mechanisms. But
6 they're so similar, I have no real issue with the
7 court's definition.

8 Q. And you agree then with the court that
9 additional graduate education could substitute for
10 professional experience and significant work experience
11 could substitute for formal education?

12 A. Those are all reasonable, sure.

13 MS. GORDON: Okay. So why don't we take a
14 quick break. I think I may not have any more
15 questions.

16 (A recess was taken.)

17 MS. GORDON: So Dr. Reinholtz, I thank you for
18 your time today and your flexibility starting
19 early. At this time, subject to any redirect, we
20 have no further questions.

21 REDIRECT (DR. CHARLES REINHOLTZ)

22 BY MR. ABRAMIC:

23 Q. I just want to do a very short redirect if we
24 could.

25 Could we go back to the Microdrones reference,

1 Dr. Reinholtz? It is Exhibit 1004.

2 A. Yes, I have it.

3 Q. And the page that we were talking about or
4 that you were being questioned about is page 27 of the
5 manual. It's page 37 on the Bate stamp.

6 A. I have it.

7 Q. And you were being asked some questions about
8 the fourth photo in Figure 25. And I'm referring to the
9 photo with the large red X. Do you recall that?

10 A. I do.

11 Q. And counsel was asking for your interpretation
12 of that photo, and you had indicated that it was your
13 understanding that that showed a blade being placed on
14 the wrong rotor. Do you recall that?

15 A. I do.

16 Q. And then counsel was also suggesting a
17 possible alternative interpretation of that photo being
18 that it depicts an instance where there were some ridges
19 on the knobs. Do you recall that?

20 A. I do, yes.

21 Q. In explaining why you thought your
22 interpretation was correct, you used the phrase "the
23 main concern" when talking about the teaching of this
24 reference.

25 Could you explain why you believe a person of

1 ordinary skill in the art would have more concern about
2 a misinstalled blade than the instance where there would
3 be ridges on the knobs?

4 A. Sure. If there were -- if there were ridges
5 on the knobs, they may not seat fully. But as long as
6 you put the right -- the clockwise blade on the
7 clockwise motor and put the O-rings on, it would still
8 fly acceptably. It would be much less of a concern.

9 If you install a clockwise blade on a
10 counterclockwise motor, which I feel certain this
11 picture is depicting, that's a major concern because as
12 soon as the rotor starts to spin the blade, instead of
13 creating a lift, it creates a downward force, the
14 negative lift, and it pushes that arm of the aircraft
15 down into the ground. It's a catastrophic situation.

16 MR. ABRAMIC: I have no further questions.

17 RE CROSS (DR. CHARLES REINHOLTZ)

18 BY MS. GORDON:

19 Q. I just have a few questions in recross.

20 So you would agree that a main concern of the
21 Microdrones reference is avoiding accidental
22 misplacement of rotor blades?

23 A. I do agree with that.

24 Q. And one last question: During any of the
25 breaks that we took today, did you discuss the substance

1 of your testimony with your counsel?

2 A. Not at all.

3 MS. GORDON: Okay. Thank you, Dr. Reinholtz.

4 We have no further questions.

5 THE WITNESS: I appreciate you being very
6 cordal, pleasant to talk to. Thank you.

7 MS. GORDON: No problem.

8

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10 (Witness excused.)

11 (Deposition was concluded.)

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1 UNITED STATES PATENT AND TRADEMARK OFFICE)
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD)

3 I, Jeana Kim, Registered Realtime Reporter,
4 certify:

5 That the foregoing proceedings were taken before me
6 at the time and place therein set forth, at which time
7 the witness was put under oath by me;

8 That the testimony of the witness, the questions
9 propounded, and all objections and statements made at
10 the time of the examination were recorded
11 stenographically by me and were thereafter transcribed;

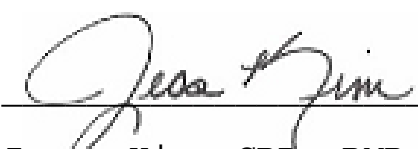
12 That a review of the transcript by the deponent was
13 not requested;

14 That the foregoing is a true and correct transcript
15 of my shorthand notes so taken.

16 I further certify that I am not a relative or
17 employee of any attorney of the parties, nor financially
18 interested in the action.

19 I declare under penalty of perjury under the laws
20 of Florida that the foregoing is true and correct.

21 Dated this 17th day of November, 2019.

22
23 
24 Jeana Kim, CRR, RMR, FPR, CLR

25

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