

**Internal distribution code:**

- (A) [ - ] Publication in OJ
- (B) [ - ] To Chairmen and Members
- (C) [ - ] To Chairmen
- (D) [ X ] No distribution

**Datasheet for the decision  
of 1 February 2022**

**Case Number:** T 2875/19 - 3.5.03

**Application Number:** 14174603.2

**Publication Number:** 2827606

**IPC:** H04Q9/00

**Language of the proceedings:** EN

**Title of invention:**

Wireless fuel sensor system and method

**Patent Proprietor:**

The Boeing Company

**Opponent:**

Airbus Operations Limited(GB) / AIRBUS SAS(FR) /  
Airbus Operations SAS(FR) / Airbus Operations GmbH  
(DE) / Airbus Operations SL(ES)

**Headword:**

Wireless fuel-tank sensors in an aircraft/BOEING

**Relevant legal provisions:**

EPC Art. 54, 56, 111(1)  
RPBA 2020 Art. 11

**Keyword:**

Novelty - requests 0, 0A and auxiliary requests 0B, 1, 1A, 1B, 2, 2A, 2B (no): direct and unambiguous teaching in prior-art document to combine different sections

Inventive step - auxiliary requests 3, 3A, 3B (no): skilled person's common general knowledge - auxiliary requests 4, 4A, 4B, 5, 5A, 5B (no): juxtaposition

Admittance of amendment after summons - auxiliary requests 1C to 7C (no): no exceptional circumstances

Remittal (no): no special reasons

**Decisions cited:**

T 0305/87



**Beschwerdekammern**

**Boards of Appeal**

**Chambres de recours**

Boards of Appeal of the  
European Patent Office  
Richard-Reitzner-Allee 8  
85540 Haar  
GERMANY  
Tel. +49 (0)89 2399-0  
Fax +49 (0)89 2399-4465

**Case Number: T 2875/19 - 3.5.03**

**D E C I S I O N**  
**of Technical Board of Appeal 3.5.03**  
**of 1 February 2022**

**Appellant I:**  
(Patent Proprietor)

The Boeing Company  
100 North Riverside Plaza  
Chicago, IL 60606-1596 (US)

**Representative:**

Witte, Weller & Partner Patentanwälte mbB  
Postfach 10 54 62  
70047 Stuttgart (DE)

**Appellant II:**  
(Opponents)

Airbus Operations Limited(GB) / AIRBUS SAS(FR) /  
Airbus Operations SAS(FR) / Airbus Operations  
GmbH  
(DE) / Airbus Operations SL(ES)  
Pegasus House  
Aerospace Avenue  
Filton  
Bristol  
BS34 7PA (GB)

**Representative:**

EIP  
Fairfax House  
15 Fulwood Place  
London WC1V 6HU (GB)

**Decision under appeal:**

**Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
19 August 2019 concerning maintenance of the  
European Patent No. 2827606 in amended form.**

**Composition of the Board:**

<b>Chair</b>	K. Bengi-Akyürek
<b>Members:</b>	K. Peirs
	C. Almberg

## Summary of Facts and Submissions

I. The appeals lie from the interlocutory decision of the opposition division to maintain the opposed patent in amended form on the basis of the claims of the proprietor's then first auxiliary request. Claim 1 of the proprietor's main request was deemed to be unallowable for lack of clarity (Article 84 EPC) and for added subject-matter (Article 123(2) EPC).

II. A communication was issued pursuant to Article 15(1) RPBA 2020 including the board's preliminary opinion concerning novelty (Article 54 EPC) and inventive step (Article 56 EPC), having regard to the following prior-art document:

**D11:** US 7 103 460 B1.

III. Oral proceedings before the board were held on 1 February 2022 by videoconference.

- The proprietor's **main request** is that the appealed decision be set aside and that the patent be maintained in amended form based on the claims of **request 0**.

Alternatively, the proprietor requests that the opponents' appeal be dismissed, meaning that the patent be maintained in amended form based on the claims of **request 0A**, i.e. the first auxiliary request as maintained in the appealed decision. Alternatively still, the proprietor requests that the appealed decision be set aside and that the patent be maintained in amended form based on the claims of one of auxiliary requests **0B, 1, 1A, 1B**,

**1C, 2, 2A, 2B, 2C, 3, 3A, 3B, 3C, 4, 4A, 4B, 4C, 5, 5A, 5B, 5C, 6C and 7C.**

The "C"-series of these claim requests, i.e. auxiliary requests 1C to 7C, were filed with a written response to the board's preliminary opinion. With the same response, the proprietor also submitted a request for **remittal** of the case to the opposition division in the event that the appealed decision is set aside.

- The opponents request that the appealed decision be set aside and that the patent be revoked.

IV. At the end of the oral proceedings, the board's decision was announced.

V. Claim 1 of **request 0**, i.e. of the proprietor's **main request**, reads as follows:

"An aircraft fuel sensor system, comprising:  
a sensor controller (202, 604) configured to send a number of wireless power signals to a group of sensor units (212; 618-632; 1100), wherein the group of sensor units (212; 618-632; 1100) is located in a fuel tank; send a number of wireless data collection signals to the group of sensor units (212; 618-632; 1100) after the number of wireless power signals have been sent to the group of sensor units (212; 618-632; 1100); and receive sensor data in a number of wireless response signals from the group of sensor units (212; 618-632; 1100)".

VI. Claim 1 of **request 0A** reads as follows (feature labelling and amendments vis-à-vis claim 1 of request 0

indicated by the board):

- (a) "An aircraft fuel sensor system, comprising:
- (b) a fuel tank;
- (c) a group of sensor units (212; 618-632; 1100),  
wherein the group of sensor units (212; 618-632;  
1100) is located in the fuel tank; and
- (d) a sensor controller (202,604) configured to
- (e) send a number of wireless power signals to the  
group of sensor units (212; 618-632; 1100);
- (f) send a number of wireless data collection signals  
to the group of sensor units (212; 618-632; 1100)  
after the number of wireless power signals have  
been sent to the group of sensor units (212;  
618-632; 1100); and
- (g) receive sensor data in a number of wireless  
response signals from the group of sensor  
units (212; 618-632; 1100)".

VII. Claim 1 of **auxiliary request 1** reads as follows  
(amendments vis-à-vis claim 1 of request 0 underlined  
by the board):

"An aircraft fuel sensor system, comprising:  
a sensor controller (202, 604) configured to send a  
number of wireless power signals to a group of sensor  
units (212; 618-632; 1100), wherein the group of sensor  
units (212; 618-632; 1100) is located in a fuel tank,  
wherein a sensor unit in the group of sensor  
units (212; 618-632; 1100) comprises a sensor (1106)  
that is a capacitive probe; send a number of wireless  
data collection signals to the group of sensor  
units (212; 618-632; 1100) after the number of wireless  
power signals have been sent to the group of sensor  
units (212; 618-632; 1100); and receive sensor data in  
a number of wireless response signals from the group of

sensor units (212; 618-632; 1100)".

- VIII. Claim 1 of **auxiliary request 1A** includes all the features of claim 1 of request 0A, with the difference that feature (c) is replaced by the following clause (amendment underlined by the board):

"a group of sensor units (212; 618-632; 1100), wherein the group of sensor units (212; 618-632; 1100) is located in the fuel tank, wherein a sensor unit in the group of sensor units (212; 618-632; 1100) comprises a sensor (1106) that is a capacitive probe; and".

- IX. Claim 1 of **auxiliary request 2** includes all the features of claim 1 of request 0 and further includes the following features (labelling and italics introduced by the board, the latter emphasising expressions which are particularly relevant for the present decision):

(h) "and wherein a sensor unit in the group of sensor units (212; 618-632; 1100) comprises:

a sensor (1106), wherein the sensor is a *capacitive probe*;

(i) an *antenna system* (1102) physically connected to the sensor, wherein the antenna system is configured to send and receive wireless signals; and

(j) an *energy harvesting device* (1302) configured to derive energy from the wireless signals received; and

(k) a *controller* (1200) configured to control the sensor to make a measurement, save the measurement as the sensor data, and send the sensor data in the



wireless signals".

X. Claim 1 of **auxiliary request 2A** includes all the features of claim 1 of request 0A however with the expression "and" removed from the end of feature (c) and further including features (h) to (k) of point IX above.

XI. Claim 1 of **auxiliary request 3** reads as follows (labelling and italics introduced by the board, the latter emphasising expressions which are particularly relevant for the present decision):

"An aircraft fuel sensor system, comprising:

a sensor controller (202, 604) configured to send a number of wireless power signals to a group of sensor units (212; 618-632; 1100); send a number of wireless data collection signals to the group of sensor units (212; 618-632; 1100) after the number of wireless power signals have been sent to the group of sensor units (212; 618-632; 1100); and receive sensor data in a number of wireless response signals from the group of sensor units (212; 618-632; 1100);

(l) wherein the number of wireless power signals, the number of wireless data collection signals and the number of wireless response signals are *radio frequency* signals;

(c') wherein the group of sensor units (212; 618-632; 1100) is located in a fuel tank,

(m) wherein radio frequency *windows* are formed in structures within the fuel tank, and

(m') wherein a sensor unit in the group of sensor units (212; 618-632; 1100) comprises:

a sensor (1106), wherein the sensor is a capacitive probe;

an antenna system (1102) physically connected to the sensor, wherein the antenna system is configured to send and receive wireless signals; and

an energy harvesting device (1302) configured to derive energy from the wireless signals received; and a controller (1200) configured to control the sensor to make a measurement, save the measurement as the sensor data, and send the sensor data in the wireless signals".

XII. Claim 1 of **auxiliary request 3A** includes all the features of claim 1 of auxiliary request 2A, and further includes features (l) and (m) as in point XI above.

XIII. Claim 1 of **auxiliary request 4**

- includes all the features of auxiliary request 3 however with feature (h) replaced by the following feature (amendment underlined by the board):

(h') "and wherein a sensor unit in the group of sensor units (212; 618-632; 1100) comprises:

a sensor (1106), wherein the sensor is selected from one of a capacitive probe and a temperature probe;"

- and further includes, between features (g) and (l), the following features (labelling and highlighting via italics by the board, the latter emphasising expressions that are of particular relevance for the present decision):

(n) "a *wireless system* (210) configured to transmit the number of wireless power signals and the number of

wireless data collection signals to the group of sensor units (212; 618-632; 1100) under a control of the sensor controller (202, 604) and receive the sensor data in the number of wireless response signals sent to the group of sensor units (212; 618-632; 1100),

- (o) wherein the wireless system (210) comprises an *antenna* (900) and a *transceiver* system (300) configured to send the number of wireless power signals and the number of wireless data collection signals to the group of sensor units (212; 618-632; 1100) using the antenna (900) and receive the sensor data received from the group of sensor units (212; 618-632; 1100) using the antenna (900),
- (p) wherein the antenna (900) is integrated within a *spar* extending across the fuel tank;"

XIV. Claim 1 of **auxiliary request 4A** includes all the features of claim 1 of auxiliary request 3A, however with feature (h) replaced by feature (h') and further including features (n) to (p) of point XIII above.

XV. Claim 1 of **auxiliary request 5** includes all the features of auxiliary request 4 however with the semi-colon at the end of feature (p) replaced by a comma, and further includes, between features (p) and (l), the following feature (labelling and italics introduced by the board, the latter highlighting an expression that is particularly important for the present decision):

- (q) "wherein the wireless system further comprises a *router system* (304) connected to the transceiver system (300) and configured to receive the sensor data from the transceiver system (300) and send the sensor data to the sensor controller (202, 604), wherein the router system is further configured to

process the sensor data prior to sending the sensor data to the sensor controller (202, 604);".

- XVI. Claim 1 of **auxiliary request 5A** includes all the features of claim 1 of auxiliary request 4A however with the semicolon at the end of feature (p) replaced by a comma, and further includes feature (q) as in point XV above.
- XVII. Claim 1 of each of **auxiliary requests 0B to 5B** includes all the features of claim 1 of request 0A and auxiliary requests 1A to 5A, respectively, however where, throughout the claim, the expression "group of sensor units" has been replaced by the term "plurality of sensor units".
- XVIII. Claim 1 of **auxiliary request 1C** reads as follows (amendments vis-à-vis claim 1 of auxiliary request 1B indicated by the board):

"An aircraft fuel sensor system, comprising:  
a fuel tank;

a plurality of sensor units (212; 618-632; 1100), wherein the plurality of sensor units (212; 618-632; 1100) is located in the fuel tank, wherein each sensor unit in the plurality of sensor units (212; 618-632; 1100) comprises a sensor (1106) that is a capacitive probe configured to measure the level of fuel in the fuel tank; and

a sensor controller (202, 604) configured to send a number of wireless power signals to the plurality of sensor units (212; 618-632; 1100); send a number of wireless data collection signals to the plurality of sensor units (212; 618-632; 1100) after the number of wireless power signals have been sent to the plurality of sensor units (212; 618-632; 1100); and receive

sensor data in a number of wireless response signals from the plurality of sensor units (212; 618-632; 1100)".

XIX. Claim 1 of **auxiliary requests 2C to 5C** includes all the features of claim 1 of auxiliary requests 2B to 5B, respectively, however where, for auxiliary requests 2C and 3C, feature (h) and, for auxiliary requests 4C and 5C, feature (h') have been replaced by the following feature (board's labelling; amendments highlighted by the board):

(h") "and

wherein each sensor unit in the plurality of sensor units (212; 618-632; 1100) comprises: a sensor (1106), wherein the sensor is a capacitive probe configured to measure the level of fluid in the fuel tank;".

XX. Claim 1 of **auxiliary request 6C**

- includes all features of claim 1 of auxiliary request 5C,
- further includes, immediately before feature (q), the following feature (labelling and italics introduced by the board, the latter emphasising an expression that is of particular relevance for the present decision):

(r) "wherein the antenna (900) takes the form of a waveguide formed within the spar (902), wherein the waveguide is a *slotted waveguide*,"

- and further includes, between features (m) and (h"), the following feature (labelled by the

board):

(s) "wherein each radio frequency window is located in a rib;"

XXI. Claim 1 of **auxiliary request 7C** includes all features of auxiliary request 6C, with the sole difference that feature (s) is replaced by the following feature (board's labelling, amendments highlighted by the board):

(t) "wherein each radio frequency window is located in a metal rib, wherein each radio frequency window is created using two passive antennas that are directly connected at the respective metal rib, wherein an aperture is formed in the respective metal rib, wherein one antenna is mounted to a forward bay with a first connector that is connected to another connector on the other side that is attached to the second antenna;".

## **Reasons for the Decision**

### 1. *Technical background*

The opposed patent relates to a sensor system 202 for measuring the fuel quantity in a fuel tank 224 of an aircraft. Typically, such a sensor system uses wires to route its sensor signals. According to the patent, in order to save time and costs as regards manufacture and maintenance of the aircraft, the *wired* system is replaced with a *wireless* system 210 (see Fig. 2 of the

patent below).

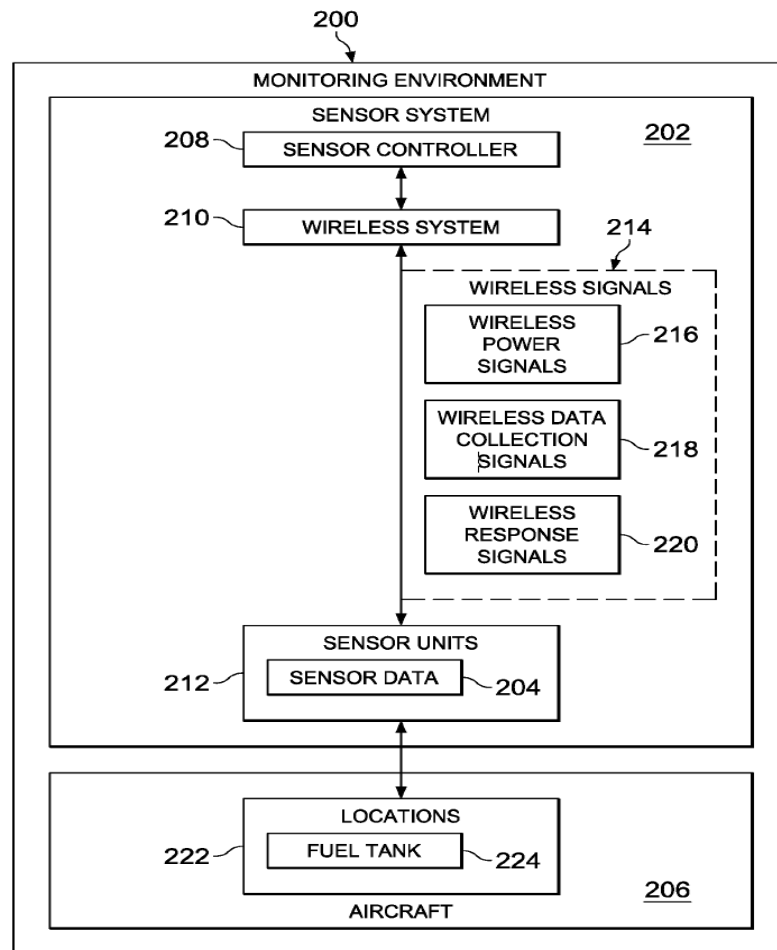


FIG. 2

2. Requests 0 and 0A: claim 1 - novelty

From points V and VI above, it is immediately apparent that claim 1 of each of requests 0 and 0A essentially comprises **features (a) and (d) to (g)** and part of **feature (c)**. Therefore, claim 1 of each of those requests can be analysed together as follows.

2.1 Regarding **features (a) to (c)**, the embodiment of Figure 88 described in column 178, lines 54 to 67 of **D11** discloses the use of surface acoustic wave (SAW) pressure devices, placed at appropriate locations

within a fuel tank to determine the fuel level. While the shape of the fuel tank of Figure 88 is similar to the one shown for an automobile in Figures 85, 86 and 86A (see column 175, line 64 to column 176, line 59), it would be readily apparent for a skilled reader, based on column 41, lines 1 to 4 and column 171, lines 12 to 24 of D11, that the same measurement procedure also works for an *aircraft* fuel tank.

Appellant I's arguments in this respect did not convince the board for the following reasons.

- 2.2 Appellant I argued that the expression "within a fuel tank" in line 57 of column 178 of D11 meant that the SAW pressure devices were being placed in the body of the fuel tank *as such*, i.e. in the wall of the fuel tank, and that nothing else was derivable from Figure 88 of D11.

In that regard, the board notes that the expression "in the fuel tank" of **feature (c)** does not necessarily mean that the group of sensor units of this feature must be located inside the fuel tank. Appellant I's indication during the oral proceedings before the board that sensors p1 to p8 are shown in Figures 6 to 9 of the opposed patent to be located inside the fuel tank 602 did not convince the board, because these figures merely represent a two-dimensional schematic illustration. By the same logic, one could instead derive from Figure 2 of the patent that sensors 222 are located around fuel tank 224.

Conversely, the expression "within a fuel tank" used in line 57 of column 178 of D11 does not necessarily imply that SAW pressure devices 794 and 795 must be inside the wall of the fuel tank. Each one of these pressure



devices is illustrated in Figure 88 of D11 inside a respective loop, which may imply that they are either inside the *wall* or inside the *fuel tank*. The latter interpretation seems to be at least hinted at also by the expression "on the bottom of the fuel tank" (emphasis added by the board) in lines 60 and 61 of column 178 of D11.

The board therefore concludes that Figure 88 of D11 in fact shows sensor units that are "in the fuel tank" as required by **feature (c)**.

- 2.3 Moreover, the board does not agree with appellant I's view that a pressure measurement using sensors which are located within the walls as in D11 would not work for an aircraft because of large differences in the amounts of fuel involved for an aircraft and an automobile, allegedly leading to different amounts of stretch affecting the SAW pressure sensors.

While the fuel amount involved for an aircraft that is capable of performing an intercontinental flight may indeed be in the range of thousands of litres, appellant II correctly pointed out that the volume of the fuel tank of feature (b) is left unspecified. In particular, this volume need not be outside the range of 50 to 80 litres, as considered by appellant I for a typical automobile. As a practical example, the most-produced aircraft worldwide, namely the *Cessna 172*, comes, in a standard implementation, with two fuel tanks of about 80 litres each.

- 2.4 The disclosure of **features (d) to (g)** in D11 was a major point of debate during the oral proceedings before the board. While appellant I correctly argued that these features are not explicitly disclosed in

Figure 88 and column 178, lines 54 to 67 of D11 considered in point 2.1 above, the board holds that D11, by means of specific instructions, guides the skilled reader to other parts of its disclosure from which these features are readily apparent. This is analysed in more detail below.

2.5 Given these specific instructions, the board does not share appellant I's assessment that the embodiment of Figure 88 of D11 should be considered in isolation (cf. T 305/87, as referred to by appellant I). For instance, it is not specified in column 178 of D11 how it can be established from a particular response signal which one of the five SAW pressure devices 794 and 795 of Figure 88 of D11 had actually replied, as pointed out by appellant II. Given further that there are at least two solutions to this "identification issue", viz.

- a "different delay" as highlighted by appellant I

and

- "a different identification code" as emphasised by appellant II,

and that neither of these solutions is implicitly present in the embodiment described with respect to Figure 88 of D11, this embodiment does not allow for a stand-alone implementation.

To establish how this "identification issue" is tackled within the context of D11, the board holds that the skilled reader would consult other passages of this document. By virtue of the expression "SAW pressure devices of this invention" (emphasis by the board) used in column 178, lines 55 and 56 of D11, the skilled

reader would readily be directed towards section 1.3 "SAW and Other Wireless Sensors" of column 91 of D11, where a general description is provided of SAW pressure devices which are relevant for the "following disclosure" (see in particular lines 15 to 17 of column 91 of D11).

The skilled reader would then learn e.g. from column 91, lines 49 to 55 of D11 that several solutions exist for the "identification issue", that is to say

- the solution of appellant I (see the expression "different delay" used in line 53 of column 91 of D11);
- the solution of appellant II, where an RFID-based switch is "associated with a sensor and turned on or off based on an identification code" (see column 91, line 53 and also column 91, line 60 to column 92, line 4 of D11);
- a further solution using space or frequency multiplexing, e.g. in that each sensor is designed to respond only to one single frequency or several frequencies (column 91, lines 49 to 55 of D11).

Thus, the skilled reader would readily use the disclosure in section 1.3 of the general part of the description of D11 to augment the teaching of the specific embodiment relating to Figure 88 of D11 and implement one of these three solutions in the embodiment of Figure 88 of D11 to address the "identification issue" mentioned above.

2.6 Moreover, appellant I could not convince the board that D11's "sensor controller" would only send out *one* type of signals rather than *two* types as required by features (e) and (f). The passage in column 91,

lines 14 to 41 of D11, which the skilled reader would immediately consult for the reasons set out in point 2.5 above, in fact explains that the sensors used in D11's configurations can be of the RFID electronic type, of the SAW type or a combination of both, the last option being already apparent from the solution proposed by appellant II mentioned in that point 2.5 above. For these configurations, an interrogator, i.e. the "sensor controller" of **feature (d)**, may transmit a "chirp form of energy" (see column 91, line 37) to provide the powerless sensors of D11 wirelessly with the necessary power (see column 162, lines 22 to 25 of D11 for an indication of how the term "powerless" is to be interpreted in this document). The board considers this *chirp form of energy* to be the "number of wireless power signals" of **feature (e)**.

Further, from the meaning of the term "interrogator" itself, the skilled reader would readily understand that the interrogator of D11 does not only power up the SAW pressure device but also provides, *after* powering up, the necessary "data collection signals" in accordance with **feature (f)** to receive the sensor data in a number of "wireless response signals" according to **feature (g)**. Otherwise, no interrogation could possibly take place. In fact, for one of its configurations, D11 even explicitly discloses the use of "power signals" followed by "data collection signals", namely for the arrangement of the solution proposed by appellant II in point 2.5 above, where an RFID-based switch is used to gate a particular SAW pressure device. At lines 44 to 46 of column 91 of D11, it is explicitly stated that, for the RFID implementation ("RFID tag"), a charging of an energy storage device takes place.

The same must evidently apply for the implementation

where an RFID-based switch is used to gate the SAW pressure device as considered by appellant II based on column 116, lines 14 to 18 and column 146, line 45 to column 148, line 8 of D11. Furthermore, specifically from column 147, line 63 to column 148, line 8 of D11, it is immediately apparent that the high retention time of the supply voltage provided by one power-up signal allows for *multiple*, independent measurements via "wireless data collection signals" as required by **feature (f)** and replies by "wireless response signals" in accordance with **feature (g)**, even when incorporating a necessary delay between the measurements.

The board notes in this respect that it is immediately evident from column 91, lines 60 to 62 of D11 that the SAW pressure devices may, prior to providing sensor data, incorporate identification information into the modulated signals, thereby providing a further delay between the radio-frequency signals acting, on the one hand, as mere *power signals* and, on the other hand, as *data collection signals*. Moreover, Figures 52A and 52C of D11, as referred to by appellant II, illustrate accordingly the necessary circuitry for and the time flow of the powering-up and the data-collection process encompassing ID-code retrieval. Hence, at least for the implementation where the SAW pressure device is switched on by an RFID-based switch, there is an explicit teaching in D11 that separate data collection signals are provided *after* the power signals have been transmitted.

- 2.7 The subject-matter of claim 1 of each of requests 0 and 0A is therefore not new (Article 54 EPC).

3. *Auxiliary requests 1, 1A, 2 and 2A: claim 1 - novelty*

3.1 Claim 1 of **auxiliary requests 1 and 1A** differs from claim 1 of requests 0 and 0A, respectively, essentially in that it further comprises **feature (h)** as defined in point IX above for claim 1 of **auxiliary request 2**.

As pointed out by appellant II, this feature is disclosed in lines 1 to 5 of column 151 of D11, where it is stated that, as an addition to the use of SAW pressure devices, the use of capacitive pressure sensors "in conjunction with an RFID tag is contemplated by the invention disclosed herein" (emphasis added by the board). Contrary to what was suggested by appellant I during the oral proceedings, the board holds that the skilled reader would immediately understand that a conjunction with the RFID tag mentioned in column 91, lines 44 to 46 of D11, which forms part of a general description of the SAW pressure devices (cf. the second paragraph of point 2.5 above), is to be considered. Hence, the skilled reader would readily understand that a *capacitive* pressure sensor may be added to the arrangement referred to in the penultimate paragraph of point 2.6 above.

3.2 Regarding the further features of claim 1 of **auxiliary requests 2 and 2A** (cf. point IX above), the board holds that **feature (i)** is inherently present in the configurations of D11 referred to in the second paragraph of point 2.6 above, namely in view of the references cited for the "wireless power signals" in accordance with feature (e) and the "wireless data collection signals" as in feature (f).

The same applies to **feature (k)**, where at least the

code-multiplexed option of the measurement procedure set out in lines 49 to 56 of column 91 of D11 requires a controller in accordance with this feature, because such code multiplexing involves at least a processing unit (and associated memory) for treating the sensor data prior to transmission.

Regarding **feature (j)**, appellant I correctly pointed out that the energy harvester of column 230, lines 47 to 59 of D11 was mentioned in the context of a "touch pad". However, the board notes that this energy harvester is supposed to harvest energy from "radio waves broadcast within the vehicle" (D11: column 230, lines 47 and 48, emphasis by the board). Because the *wireless power* and *data collection signals* identified in the context of features (e) and (f) in point 2.6 above constitute such radio waves (cf. point 4.1 below), the energy harvester of column 230, lines 47 to 59 of D11 has at least a functional relationship with components of the sensor unit involving the sensors mentioned in point 2.6 above. Given that the scope of the term "sensor unit" of feature (i) is broad and that claim 1 is silent about how the energy-harvesting device of feature (j) relates to the other features of claim 1, the board holds that this functional relationship would suffice for the skilled reader to conclude that the energy harvester of D11 is part of D11's sensor unit in the same way as the energy harvester of feature (j) is part of the sensor unit of feature (i).

3.3 Consequently, the subject-matter of claim 1 of each of auxiliary requests 1, 1A, 2 and 2A is not new (Article 54 EPC).

4. *Auxiliary requests 3 and 3A: claim 1 - inventive step*
- 4.1 Regarding claim 1 of **auxiliary requests 3 and 3A**, respectively, **feature (1)** (cf. point XI above) is at least implied by the term "RFID" mentioned in the context of the configurations of D11, as in the second paragraph of point 2.6 above. Moreover, concerning **feature (c')** (see also point XI above) the same reasoning applies as for feature (c) of point 2.1 above. Regarding the other features of claim 1, it is immediately apparent from point XI above that these amount to features (a) and (d) to (k) with the definite pronoun "the" in feature (e) replaced by its indefinite counterpart. For the reasons set out in point 2 above, these other features cannot lead to the acknowledgement of novelty either.
- 4.2 By contrast, **feature (m)** is not disclosed in D11. Yet, it cannot contribute to inventive step (Article 56 EPC) for the reasons set out below.
- 4.2.1 For the sake of argument, the board will construe feature (m) in the sense that, as brought forward by appellant I during the oral proceedings before the board, the "radio-frequency windows" would indeed allow the radio-frequency signals of feature (1) to pass physically between the sensor units of features (e) to (g) and the sensor controller of feature (d), i.e. through (at least a part of) the wall of the fuel tank. The board particularly agrees that the skilled reader would realise that the reachability of the SAW pressure devices in D11 might be a cause for concern, as argued by appellant I.

The board finds it expedient to highlight in this respect that an aircraft fuel tank is typically made of



a metal such as an aluminium alloy or stainless steel, which makes the fuel tank act like a Faraday cage. The extent to which any electromagnetic wave can penetrate a metal object is expressed by the so-called "penetration depth", which decreases exponentially with the frequency of the wave. Radio waves have a frequency in the range from 3 kHz to 300 GHz and their penetration depth will be severely limited at least for frequencies in the higher part of this radio-frequency range. As a practical example, for a frequency of 1 MHz, the penetration depth is already less than 0.1 mm for aluminium and less than 0.4 mm for stainless steel. The arrangement of the RFID-based switch combined with SAW sensors (cf. the penultimate paragraph of point of 2.6 above) requires, at least for charging, a frequency range of 905 MHz to 925 MHz (see column 91, line 37 of D11). The penetration depth for these radio waves will correspondingly amount to a negligible fraction of the total wall thickness of the fuel tank.

- 4.2.2 The objective technical problem can therefore be framed as *"how to enable the wireless reachability of the sensors in the fuel tank in D11"*, to which both parties explicitly agreed during the oral proceedings.
- 4.2.3 The skilled person who is qualified to solve this problem belongs to the field of radio-transmission systems.
- 4.2.4 In view of the negligible penetration depth for at least some of the radio frequencies used in D11 (see point 4.2.1 above), the board agrees with appellant II's argument that this skilled person would have implemented feature (m) as a matter of routine design. In other words, the skilled person would have

selected this option out of equally likely alternatives in order to make the wireless exchange between the interrogator and the SAW pressure devices in D11 possible in the first place. Appellant I expressed during the oral proceedings that, in its view, the measurement in the embodiment of Figure 88 of D11 took place outside the fuel tank, which obviated the need to provide for openings according to feature (m). However, the board notes that this view is precluded by the clause "multiple sensors can be placed at appropriate locations within a fuel tank" (emphasis by the board) in column 178, lines 56 and 57 of D11.

4.3 Hence, the subject-matter of claim 1 of each of auxiliary requests 3 and 3A does not involve an inventive step (Article 56 EPC).

5. *Auxiliary requests 4 and 4A: claim 1 - inventive step*

5.1 Concerning claim 1 of **auxiliary requests 4 and 4A** respectively, **features (n) and (o)** (cf. point XIII above) are necessarily implied in D11's configurations referred to in the second paragraph of point 2.6 above (see the references to D11 mentioned in that context for the "wireless power signals" and the "wireless data collection signals" in accordance with features (e) and (f) respectively). Moreover, the scope of **feature (h')** is broader than feature (h) and, hence, cannot establish novelty.

5.2 While the board agrees with appellant I that **feature (p)** is not disclosed in D11 (Article 54 EPC), it cannot see, for the following reasons, that this feature could contribute to inventive step (Article 56 EPC).

- 5.2.1 First, it is apparent to the board that features (m) and (p) relate to two separate aspects, i.e. to two partial problems.
- 5.2.2 In point 4.2.1 above, the technical effect of **feature (m)** was established to relate to the wireless reachability of the sensor units according to features (c) and (e) to (g).
- 5.2.3 By contrast, **feature (p)** concerns the mechanical arrangement of an antenna that is part of the wireless system according to feature (n) with respect to the fuel tank of feature (b). In particular, as was submitted by appellant II, the only technical effect that can credibly be attributed to feature (p) is to provide for a practical mechanical arrangement of the antenna of feature (o) in the aircraft fuel sensor system of feature (a).
- 5.2.4 While appellant I correctly observed that an arrangement which brought the antenna closer to the sensor units might lead to a somewhat "better" wireless reachability, the board shares appellant II's view that the skilled reader would be able to foresee immediately any potential benefits for the wireless reachability due to a change in the mechanical arrangement of the antenna, e.g. by implementing this antenna in accordance with feature (p).

The board notes in this respect that the arrangement in accordance with feature (p) does even not necessarily improve the wireless reachability of the sensor units by the antenna of the aircraft's wireless system. This is because the latter depends on several aspects, such as

- the degree to which the antenna extends within the spar

or

- the precise location and, for directional antennae, the orientation of the antenna with respect to the sensor units according to features (c), (e), (f) and (g).

However, feature (p) is silent about these aspects. In particular, it does not require the antenna to extend across the entire length of the spar or, correspondingly, to reach through the entire fuel tank, contrary to what was suggested by appellant I. In particular, the distance between the antenna of features (o) and (p) and the sensor units of features (c) to (g) is not necessarily minimised by virtue of feature (p).

5.2.5 Consequently, the board agrees with appellant II that features (m) and (p) constitute a mere juxtaposition of well-known implementation measures. As a result, their respective inventive-step assessments can be conducted independently by means of partial problems individually associated with each distinguishing feature:

- For the partial problem and the associated assessment of obviousness regarding **feature (m)**, the board refers to point 4.2 above.
- The objective technical problem corresponding to **feature (p)** can be framed as "*how to provide for a practical mechanical arrangement of the antenna in the wireless system of the aircraft of D11*". The skilled person qualified to solve this problem

belongs to the field of aerials adapted for use in or on aircraft. Based on their common general knowledge, this skilled person would have immediately considered the spar of an airplane wing to be an appropriate candidate for solving the objective technical problem posed. Hence, the board agrees with the opinion of appellant II that the skilled person would indeed have integrated the antenna into the spar as a matter of routine design without exerting any inventive activity.

- 5.3 As a result, the subject-matter of claim 1 of each of auxiliary requests 4 and 4A does not involve an inventive step (Article 56 EPC).
6. *Auxiliary requests 5 and 5A: claim 1 - inventive step*
- 6.1 With respect to claim 1 of **auxiliary requests 5 and 5A** respectively, **feature (q)** (cf. point XV above) is also not disclosed in D11, thereby leading to a third distinguishing feature (Article 54 EPC).
- 6.2 To determine whether feature (q) yields a synergistic technical effect with any of features (m) and (p), its technical effect must first be identified.
- 6.2.1 Appellant I argued that the "router system" according to feature (q) collected all the sensor data prior to their transmission, which in turn allowed usage of *one* controller as in feature (k) to receive data from *multiple* sensor units in a star-like configuration.
- 6.2.2 The board does not agree that the skilled reader would ascribe this technical effect to feature (q): a router is a networking device that forwards data packets between computer networks at the third layer of the

well-established OSI model in telecommunications. While several data lines may, of course, be connected to the router in a star-like configuration, the board notes that this is not specified in feature (q). In particular, the skilled reader would interpret the general term "processing" of this feature within the context of a router system as a mere "passing on".

The board therefore holds that the only technical effect that can, at most, be credibly attributed to feature (q) is to provide for a practical implementation of forwarding the data from the sensor units of features (c) and (e) to (g) to the controller of feature (k) for storing or (further) processing.

6.2.3 Appellant I correctly emphasised during the oral proceedings before the board that the antenna system of the sensor unit as to feature (i) differed from the antenna as to features (o) and (p). The board can, correspondingly, recognise no synergistic technical effect between the practical implementation implied by feature (q) as set out in point 6.2.2 above and the practical mechanical arrangement provided for by feature (p) as laid out in point 5.2.3 above. The "router system" of feature (q) is therefore just another component of the wireless system of feature (n) and constitutes no more than a mere aggregation when put together with the antenna of features (o) and (p).

6.2.4 Moreover, the board cannot see any combined technical effect that would result from a combination of the *wireless reachability* imparted by feature (m) as set out in point 4.2.1 above and the *practical implementation* entailed by feature (q) in accordance with point 6.2.2 above. Hence, features (m) and (q)

also represent a mere juxtaposition.

- 6.3 Consequently, the inventive-step analysis for feature (q) can be carried out by means of another partial problem associated with this feature taken by itself.
- 6.3.1 The objective technical problem corresponding to the technical effect mentioned in point 6.2.2 above and associated with feature (q) can thus be formulated as *"how to provide for a practical implementation for forwarding the sensor data in D11"*.
- 6.3.2 The skilled person faced with this objective technical problem comes from the field of digital communication. The board holds that for this skilled person, based on their common general knowledge, the router of feature (q) was (and still is) no more than a standard component. Moreover, the skilled person would have readily adopted such a router to solve the objective problem posed, depending on how circumstances dictate.
- 6.3.3 As a result, feature (q) cannot lead to the acknowledgement of an inventive step either.
- 6.4 Therefore, the subject-matter of claim 1 of each of auxiliary requests 5 and 5A does not involve an inventive step (Article 56 EPC).
7. *Auxiliary requests 0B to 5B: claim 1 - novelty and inventive step*
- 7.1 Regarding claim 1 of **auxiliary requests 0B to 5B** respectively, appellant I argued that the replacement of the expression "group of sensor units" of claim 1 of auxiliary requests 0A to 5A respectively by the term

"plurality of sensor units" (cf. point XVIII above) was performed to exclude the interpretation that a "group of sensor units" could consist of only one sensor unit.

7.2 Given that Figure 88 of D11 discloses in total five SAW pressure devices (labelled with reference numerals "794" and "795"), the board cannot see how this replacement could alter the conclusion reached for claim 1 of auxiliary requests 0A to 5A, respectively, in points 2.7, 3.3, 4.3, 5.3 and 6.4 above.

7.3 Regarding claim 1 of **auxiliary request 1B** in particular, appellant I emphasised that each of the sensor units comprised a "capacitive sensor", but the board does not agree that the skilled reader would interpret the features of this claim 1 in such a strict sense. Even if they did, the board holds that the passage at lines 1 to 5 of column 151 of D11 does not pose any limitations on the number of "capacitive pressure sensors" that are added to the arrangement of point 2.6 above. As a result, the skilled person would immediately have arrived at an implementation with each of the sensor units comprising a capacitive pressure sensor based on nothing but a routine design measure.

7.4 Hence, the subject-matter of claim 1 of each of auxiliary requests 0B to 5B is not new (Article 54 EPC) and/or does not involve an inventive step (Article 56 EPC).

8. *Auxiliary requests 1C to 7C: admittance into the proceedings*

8.1 **Auxiliary requests 1C to 7C** were filed *after* the notification of the summons to oral proceedings before the board (cf. point III above). Accordingly, their



admittance into the proceedings is at the discretion of the board under Article 13(2) RPBA 2020 (which includes the power to rely on criteria applicable under Article 13(1) RPBA 2020).

8.2 Appellant I explained that auxiliary requests 1C to 7C were filed as a reaction to the board stating in its preliminary opinion with respect to **feature (h)** that "it is not immediately apparent whether the capacitive sensor is to be used in *addition* to or as a *replacement* for some of the SAW pressure devices" (emphasis as in the original). While this statement by the board merely served to illustrate how broadly feature (h) had been drafted, appellant I seemed to have interpreted it, erroneously, as a "new" objection.

8.3 Moreover, appellant I argued that the presence of *multiple* capacitive probes configured to measure the level of fuel in the fuel tank, as required by **feature (h")** (cf. point XIX above), was not disclosed in D11 and yielded the technical effect of making a fuel level measurement independent of the orientation of the aircraft when being in operation.

However, even if this technical effect were credibly derivable from feature (h"), this would, in the board's view, not represent a cogent reason justifying an exceptional circumstance by which admittance of any of auxiliary requests 1C to 7C into the proceedings would be warranted (Article 13(2) RPBA 2020).

8.4 Furthermore, appellant I noted for auxiliary requests 6C and 7C that **features (s) and (t)** (cf. points XX and XXI above) specify that the structures of feature (m) were, in fact, (metal) ribs, which was not disclosed in the prior-art documents on file. They

emphasised that these features did not represent a "new direction" but merely constituted a further refinement of feature (m) to react to the preliminary opinion of the board.

Regardless of whether these amendments would *prima facie* overcome the issues raised without giving rise to new objections (cf. Article 13(1) RPBA 2020), no exceptional circumstances are at hand and no cogent reason have been presented by appellant I within the meaning of Article 13(2) RPBA 2020.

8.5 Auxiliary requests 1C to 7C are therefore not admitted into the appeal proceedings (Article 13(2) RPBA 2020).

9. *Request for remittal*

9.1 Appellant I requested remittal of the case to the opposition division for reasons of fairness, because there was at no point during the preceding examination and opposition proceedings a substantive discussion of the subject-matter of the claims in terms of the disclosure of the prior art.

9.2 Appellant II, however, correctly argued that a smooth prosecution of a patent application and its ensuing patent should not entitle appellant I to an (additional) advantage in the appeal proceedings. Moreover, the board agrees that appellant I has had sufficient time to react to the teaching of D11, given that this document was already admitted into the proceedings by the opposition division during the oral proceedings before it.

9.3 The board also notes in this respect that appellant I filed numerous auxiliary requests with its reply to

appellant II's appeal according to which the patent should be maintained in amended form. Given that this reply was filed in due time following a statement of grounds of appeal filed *before* the entry into force of the RPBA 2020, the transitional provisions according to Articles 24(1) to 25(2) RPBA 2020 should be adhered to, according to which Article 12(4) RPBA 2007 continued to apply. In accordance with this latter provision, the board acted in line with established practice when taking these multiple auxiliary requests into account in its preliminary opinion.

- 9.4 As a result, the board cannot recognise any "special reasons" within the meaning of Article 11 RPBA 2020 to remit the case to the opposition division. The request for remittal is therefore refused (Article 111(1) EPC).

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chair:



B. Brückner

K. Bengi-Akyürek

Decision electronically authenticated