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Kreiner et al.

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(54) **COMPUTER AIDED DISPATCH OF DRONES**

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(51) **Int. Cl.**

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B64C 39/02	(2006.01)
G06Q 10/00	(2012.01)

(52) **U.S. Cl.**

CPC ***G08G 5/0043*** (2013.01); ***B64C 39/024*** (2013.01); ***G06Q 10/00*** (2013.01); ***G08G 5/0013*** (2013.01); ***G08G 5/0034*** (2013.01); ***G08G 5/0069*** (2013.01); ***G08G 5/0082*** (2013.01); *B64C 2201/027* (2013.01); *B64C 2201/08* (2013.01); *B64C 2201/14* (2013.01)

(58) **Field of Classification Search**

CPC .. G08G 5/0069; G08G 5/0043; G08G 5/0082; G08G 5/0013; G05D 1/0011; B64C 39/024; G06Q 10/00

USPC 701/2, 3

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,134,500 A	10/2000	Tang et al.
6,999,876 B2	2/2006	Lambert et al.
7,245,216 B2	7/2007	Burkley et al.

(Continued)

OTHER PUBLICATIONS

Lawrence, James D., "Local Area Drone Dispatch and Authorization System (LADDAS)," Kick Starter, kicstarter.com, <https://www.kickstarter.com/projects/42193299/local-area-drone-dispatchand-authorization-system>, dated Sep. 28, 2015 (8 pages).

(Continued)

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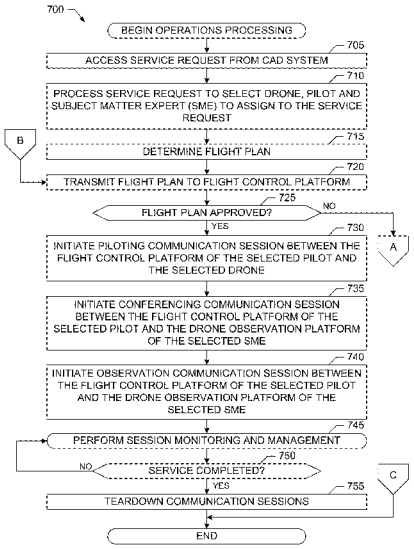
(57) **ABSTRACT**

Methods, apparatus, systems and articles of manufacture to implement computer aided dispatch of drones are disclosed. Example drone dispatching methods disclosed herein include transmitting a flight plan for a drone to a flight control platform, the flight plan based on a first location associated with a service request. Disclosed example methods also include, in response to receiving a message from the flight control platform indicating the flight plan is approved, initiating a first communication session between the flight control platform and a flight control unit of the drone to permit remote piloting of the drone. Disclosed example methods further include, in response to receiving the message from the flight control platform indicating the flight plan is approved, initiating a second communication session to exchange multimedia data between the flight control platform and a drone observation platform separate from the flight control platform.

20 Claims, 13 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

7,451,023	B2	11/2008	Appleby et al.	
7,509,212	B2	3/2009	Bodin et al.	
7,693,624	B2	4/2010	Duggan et al.	
7,937,068	B2	5/2011	Hogberg et al.	
8,515,609	B2	8/2013	McAndrew et al.	
8,751,061	B2	6/2014	Coulmeau et al.	
8,849,476	B2	9/2014	Coulmeau	
8,929,851	B2	1/2015	Mills et al.	
8,948,935	B1	2/2015	Peeters et al.	
8,983,682	B1	3/2015	Peeters et al.	
9,002,384	B1	4/2015	Hallenbeck	
9,051,043	B1	6/2015	Peeters et al.	
9,061,102	B2	6/2015	Levien et al.	
9,064,222	B2	6/2015	Saad et al.	
9,087,451	B1	7/2015	Jarrell	
9,489,852	B1 *	11/2016	Chambers	B64C 39/024
2008/0125933	A1	5/2008	Williams et al.	
2010/0159976	A1	6/2010	Marocchi et al.	
2010/0250022	A1	9/2010	Hines et al.	
2011/0130636	A1	6/2011	Daniel et al.	
2012/0143482	A1 *	6/2012	Goossen	G08G 5/0069 701/120
2012/0175468	A1	7/2012	Zerof	
2014/0142785	A1 *	5/2014	Fuentes	G05D 1/0011 701/2
2014/0222248	A1	8/2014	Levien et al.	
2014/0222250	A1 *	8/2014	Khazan	G05D 1/0022 701/2
2015/0063202	A1	3/2015	Mazzarella et al.	
2015/0148988	A1	5/2015	Fleck	
2015/0346722	A1 *	12/2015	Herz	G05D 1/0038 701/2
2016/0370800	A1 *	12/2016	Chau	G05D 1/0088

OTHER PUBLICATIONS

Policeone Staff,"Security app flies drones to your location in emergency," PoliceOne.com, <http://www.policeone.com/police-products/police-technology/Emergency-Response/articles/7830668-Security-app-flies-drones-to-your-location-in-emergency/>, dated Nov. 17, 2014 (1 page).

Starr, Michelle, "Ambulance drone unveiled in Netherlands," EMS1.com, ems1.com, <http://www.ems1.com/technology/articles/2011247-Ambulance-drone-unveiledin-Netherlands/>, dated Oct. 29, 2014 (1 page).

Roberts, Mary Rose, "5 drone technologies for EMS: The commercialization of unmanned aerial aircrafts is leading to innovative, off-the-shelf tools for EMS," EMS1.com, <https://www.ems1.com/ems-products/cameras-video/articles/1882799-5-dronetechnologies-for-EMS/>, dated Apr. 10, 2014 (3 pages).

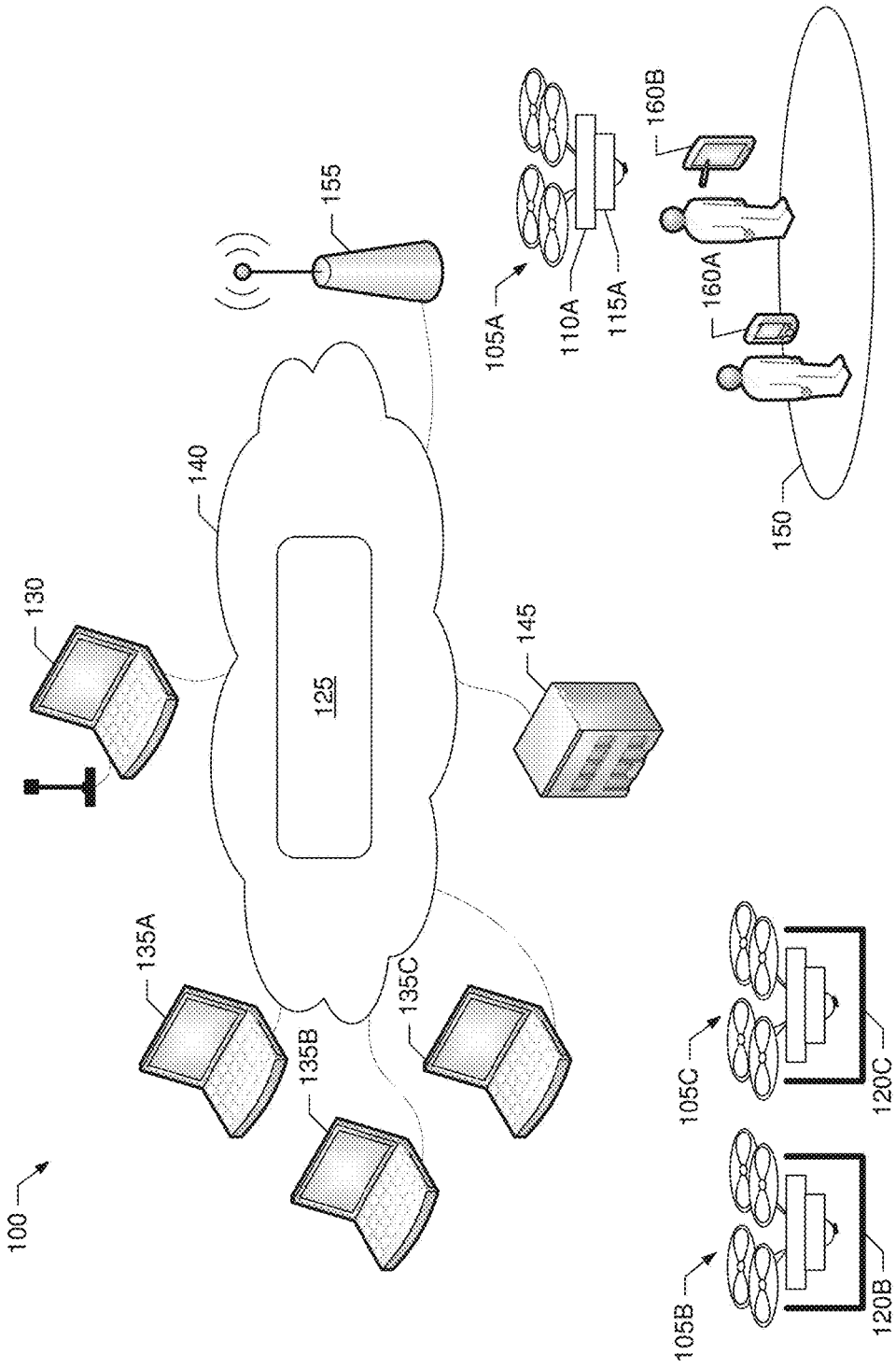
Fly 4 Me, "The Future of on Demand Drones Is Here", <http://fly4me/>, last retrieved on Sep. 17, 2015 (7 pages).

Fung, Brian, "The FAA's drone rules won't require a pilot's license, after all", The Washington Post, Feb. 15, 2015 (2 pages).

GoFor, "Gofor: Drones on Demand", <http://gofordrones.com>, last retrieved on Sep. 17, 2015 (5 pages).

Dillow, Clay, "As commercial drove use soars, 'drone services' take flight", Fortune.com, Jul. 17, 2015 (4 pages).

* cited by examiner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105A
105B
105C
110A
115A
120B
120C
125
130
135A
135B
135C
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145
150
155
160A
160B

FIG. 1

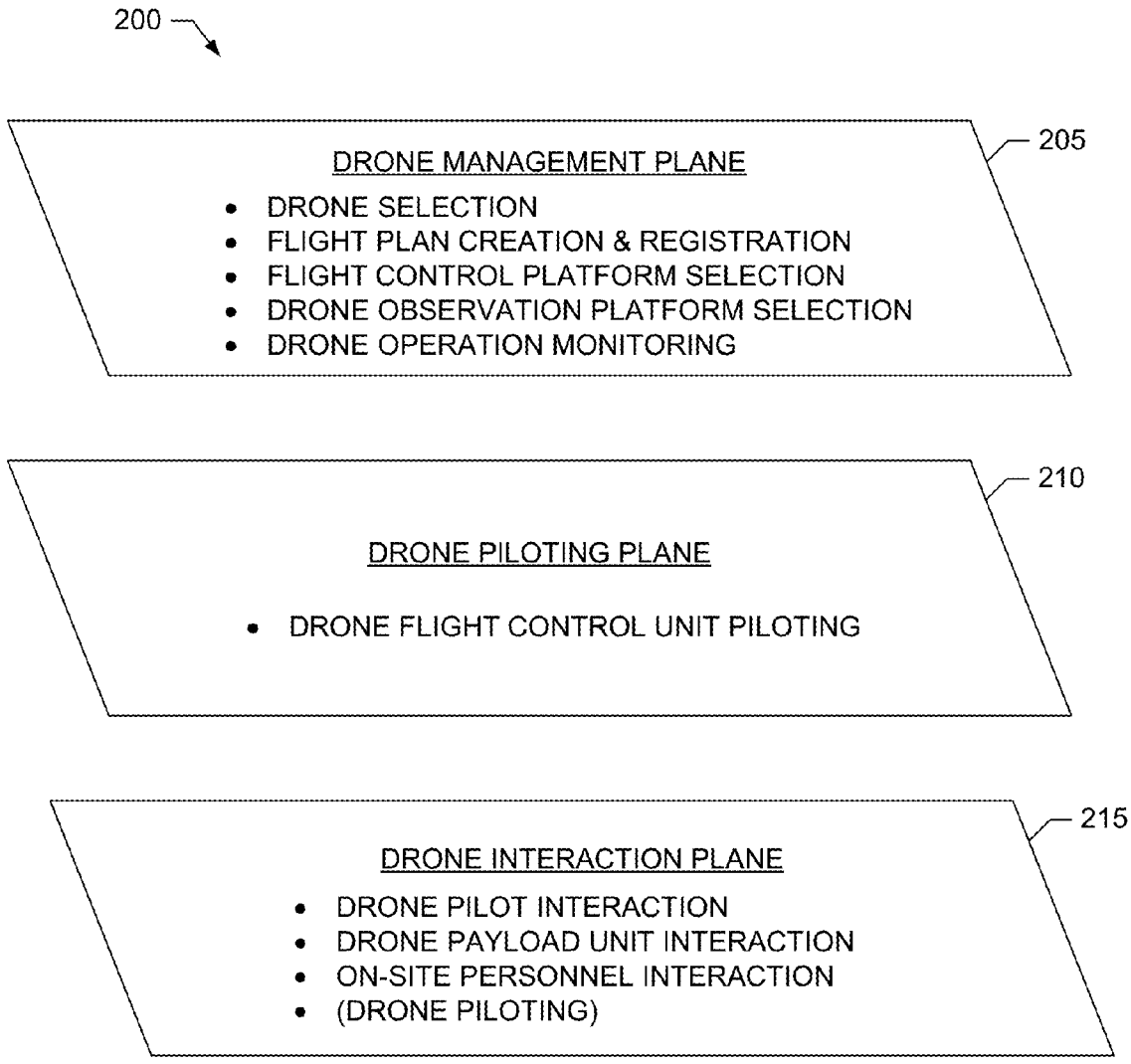

200
205
DRONE MANAGEMENT PLANE
• DRONE SELECTION
• FLIGHT PLAN CREATION & REGISTRATION
• FLIGHT CONTROL PLATFORM SELECTION
• DRONE OBSERVATION PLATFORM SELECTION
• DRONE OPERATION MONITORING
210
DRONE PILOTING PLANE
• DRONE FLIGHT CONTROL UNIT PILOTING
215
DRONE INTERACTION PLANE
• DRONE PILOT INTERACTION
• DRONE PAYLOAD UNIT INTERACTION
• ON-SITE PERSONNEL INTERACTION
• (DRONE PILOTING)

FIG. 2

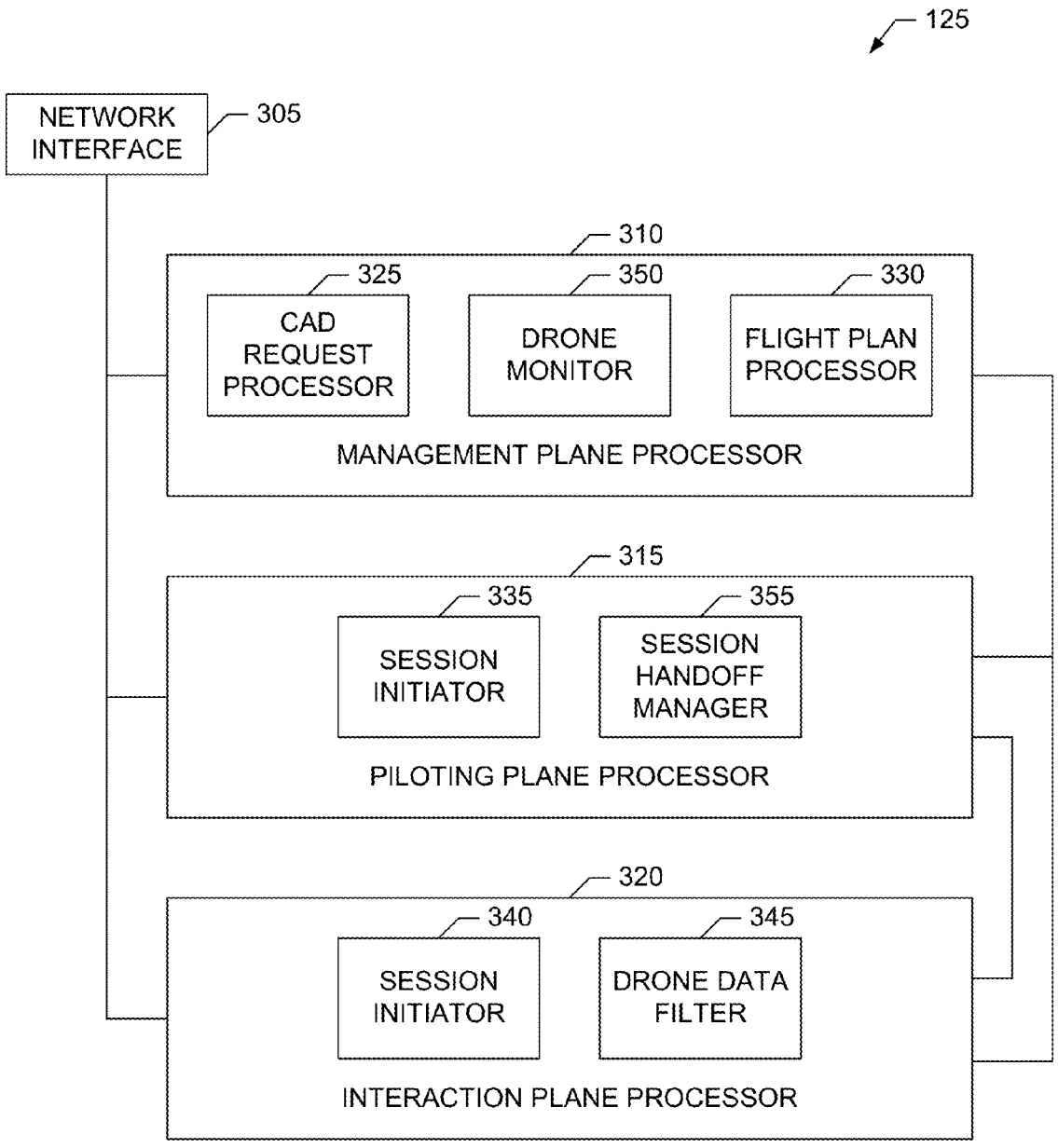
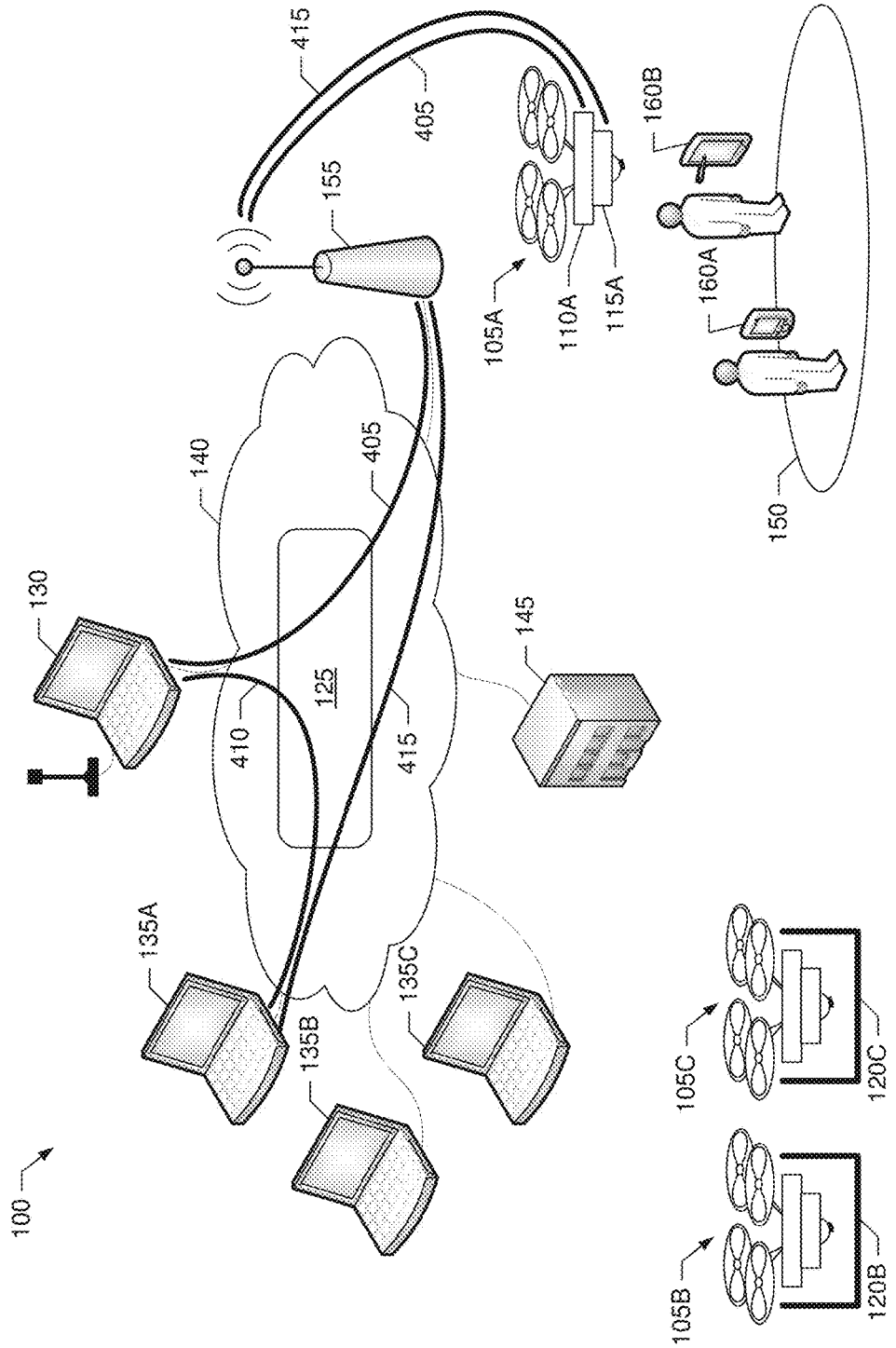

125
NETWORK INTERFACE
305
310
325
CAD REQUEST PROCESSOR
350
DRONE MONITOR
330
FLIGHT PLAN PROCESSOR
MANAGEMENT PLANE PROCESSOR
315
335
SESSION INITIATOR
355
SESSION HANDOFF MANAGER
PILOTING PLANE PROCESSOR
320
340
SESSION INITIATOR
345
DRONE DATA FILTER
INTERACTION PLANE PROCESSOR

FIG. 3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105A
105B
105C
110A
115A
120B
120C
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135A
135B
135C
140
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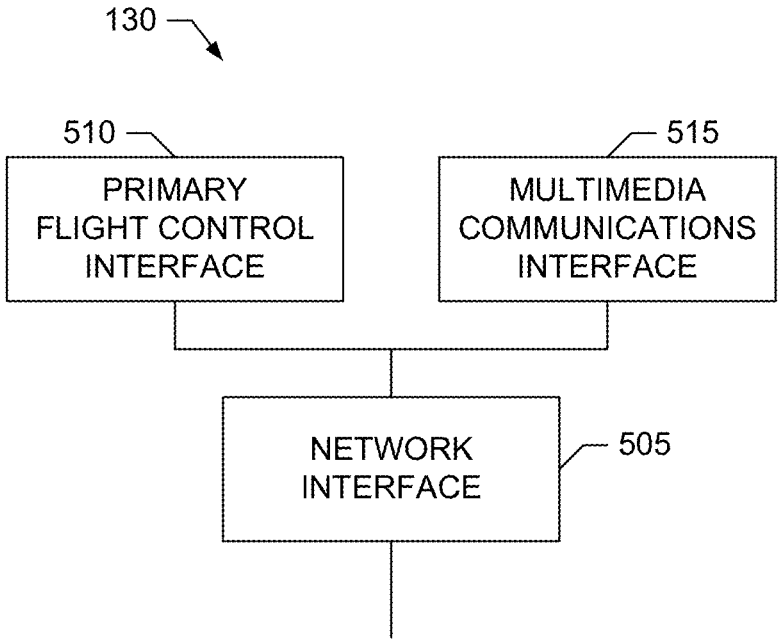
150
155
160A
160B
405
410
415

FIG. 4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510
PRIMARY FLIGHT CONTROL INTERFACE
515
MULTIMEDIA COMMUNICATIONS INTERFACE
NETWORK INTERFACE
505

FIG. 5

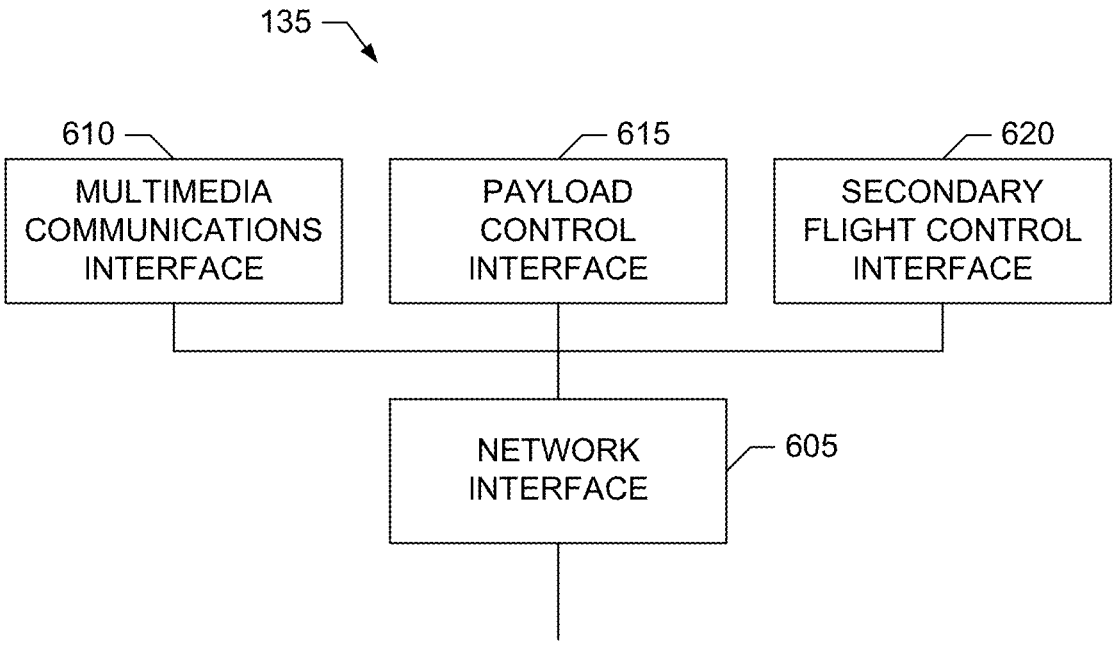

135
610
MULTIMEDIA COMMUNICATIONS INTERFACE
615
PAYLOAD CONTROL INTERFACE
620
SECONDARY FLIGHT CONTROL INTERFACE
NETWORK INTERFACE
605

FIG. 6

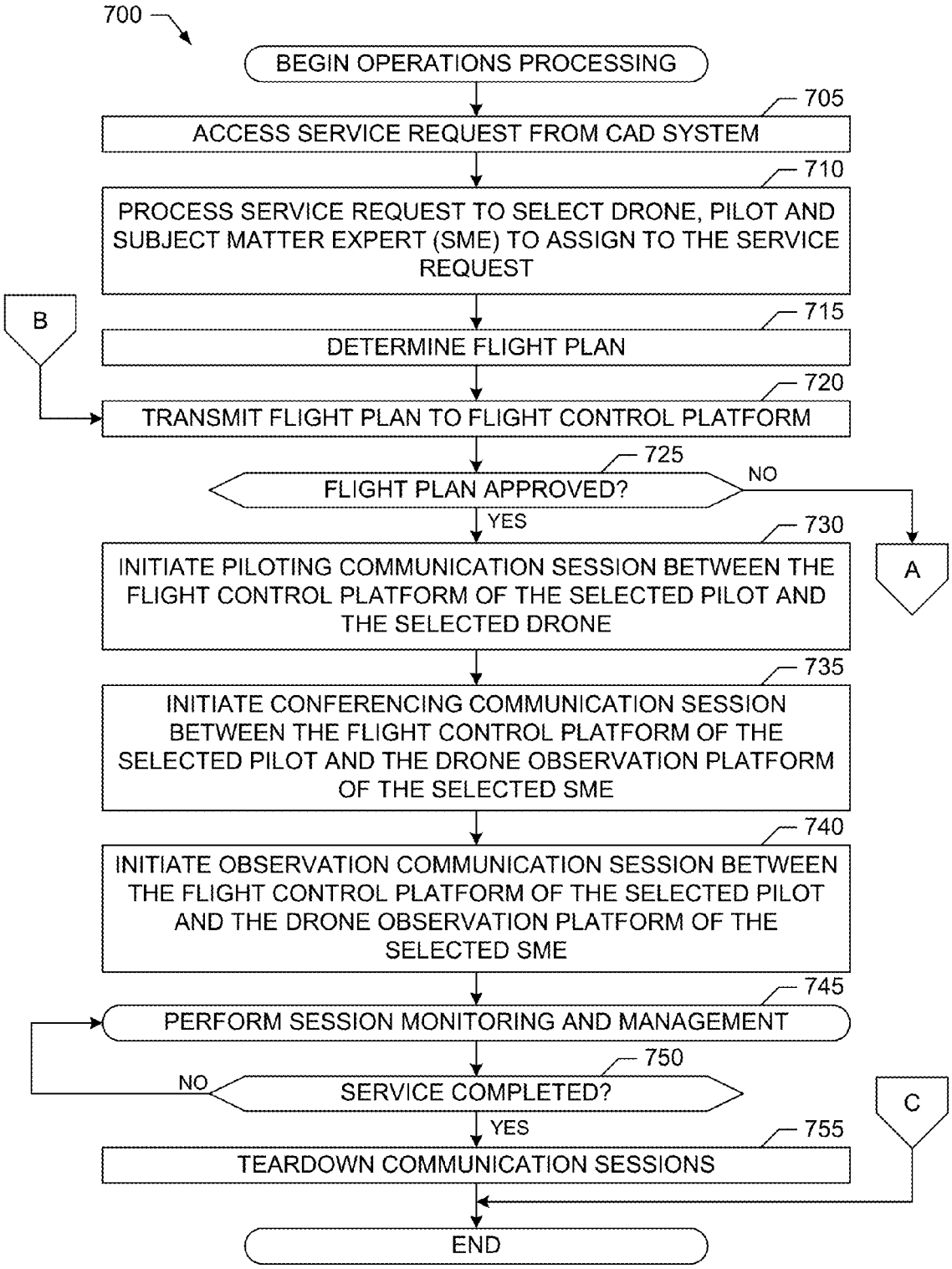

700
BEGIN OPERATIONS PROCESSING
705
ACCESS SERVICE REQUEST FROM CAD SYSTEM
710
PROCESS SERVICE REQUEST TO SELECT DRONE, PILOT AND SUBJECT MATTER EXPERT (SME) TO ASSIGN TO THE SERVICE REQUEST
B
715
DETERMINE FLIGHT PLAN
720
TRANSMIT FLIGHT PLAN TO FLIGHT CONTROL PLATFORM
725
FLIGHT PLAN APPROVED?
NO
YES
A
730
INITIATE PILOTING COMMUNICATION SESSION BETWEEN THE FLIGHT CONTROL PLATFORM OF THE SELECTED PILOT AND THE SELECTED DRONE
735
INITIATE CONFERENCING COMMUNICATION SESSION BETWEEN THE FLIGHT CONTROL PLATFORM OF THE SELECTED PILOT AND THE DRONE OBSERVATION PLATFORM OF THE SELECTED SME
740
INITIATE OBSERVATION COMMUNICATION SESSION BETWEEN THE FLIGHT CONTROL PLATFORM OF THE SELECTED PILOT AND THE DRONE OBSERVATION PLATFORM OF THE SELECTED SME
745
PERFORM SESSION MONITORING AND MANAGEMENT
750
NO
SERVICE COMPLETED?
C
YES
755
TEARDOWN COMMUNICATION SESSIONS
END

FIG. 7A

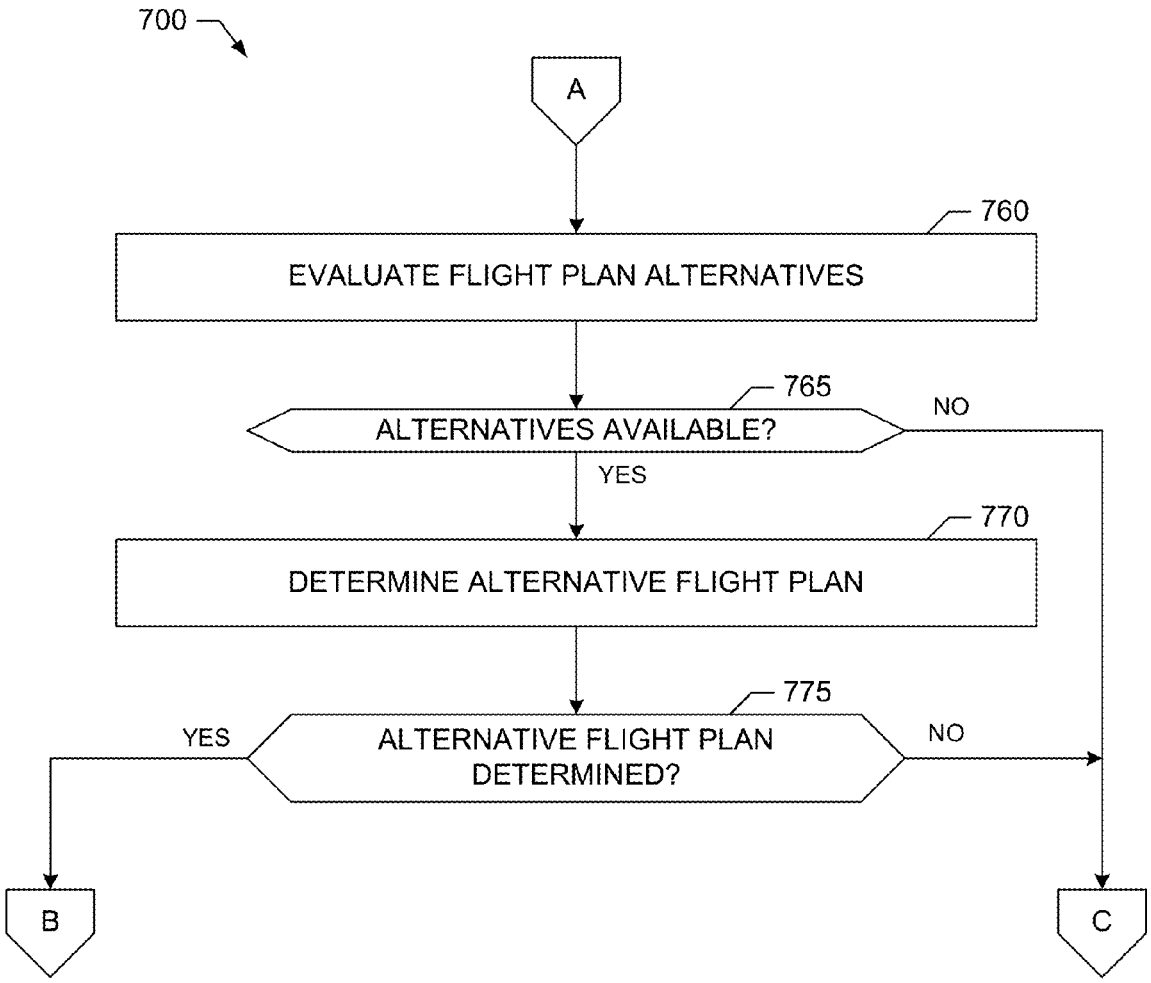

700
A
760
EVALUATE FLIGHT PLAN ALTERNATIVES
765
ALTERNATIVES AVAILABLE?
NO
YES
770
DETERMINE ALTERNATIVE FLIGHT PLAN
775
YES
ALTERNATIVE FLIGHT PLAN DETERMINED?
NO
B
C

FIG. 7B

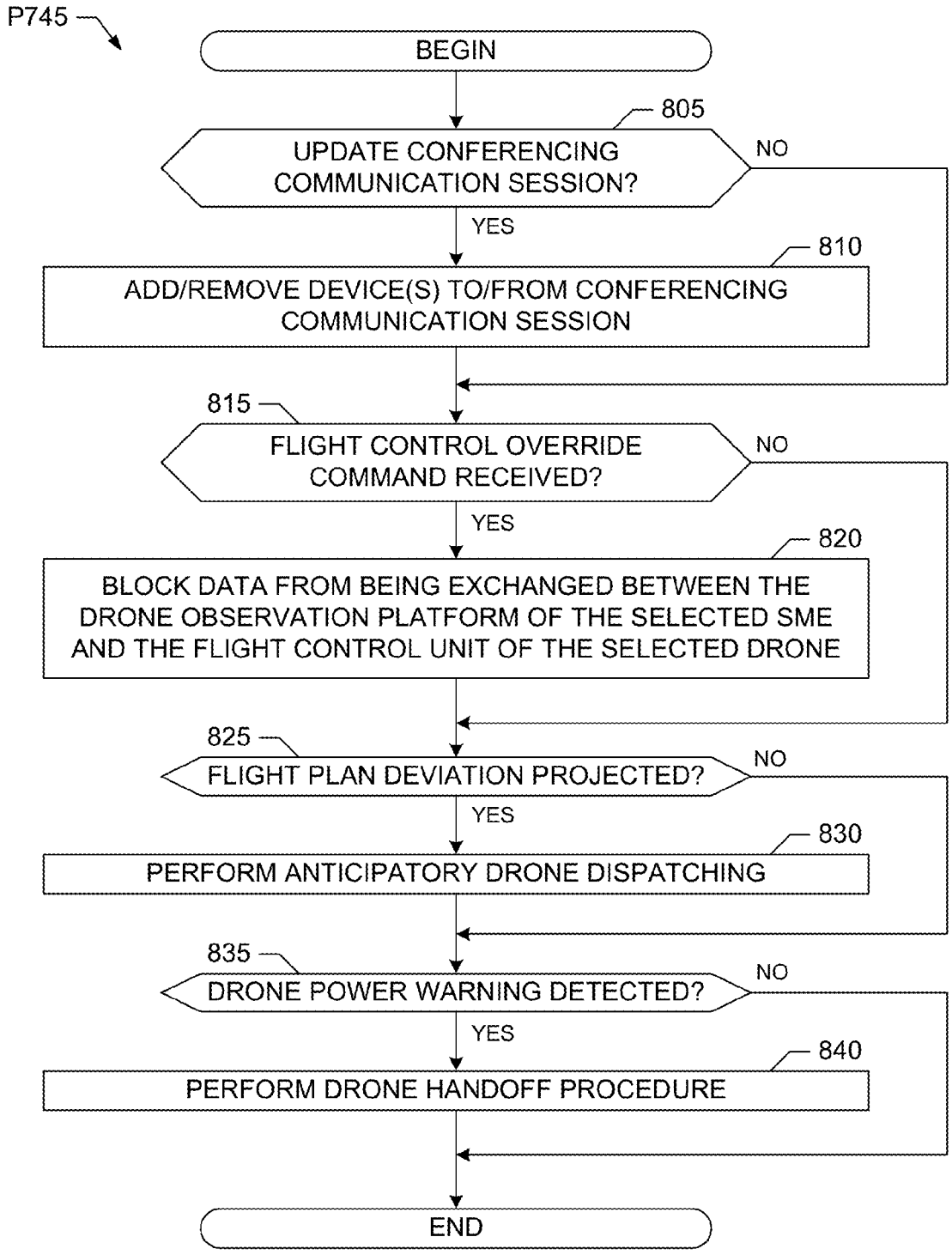

P745
BEGIN
805
UPDATE CONFERENCING COMMUNICATION SESSION?
NO
YES
810
ADD/REMOVE DEVICE(S) TO/FROM CONFERENCING COMMUNICATION SESSION
815
FLIGHT CONTROL OVERRIDE COMMAND RECEIVED?
NO
YES
820
BLOCK DATA FROM BEING EXCHANGED BETWEEN THE DRONE OBSERVATION PLATFORM OF THE SELECTED SME AND THE FLIGHT CONTROL UNIT OF THE SELECTED DRONE
825
FLIGHT PLAN DEVIATION PROJECTED?
NO
YES
830
PERFORM ANTICIPATORY DRONE DISPATCHING
835
DRONE POWER WARNING DETECTED?
NO
YES
840
PERFORM DRONE HANDOFF PROCEDURE
END

FIG. 8

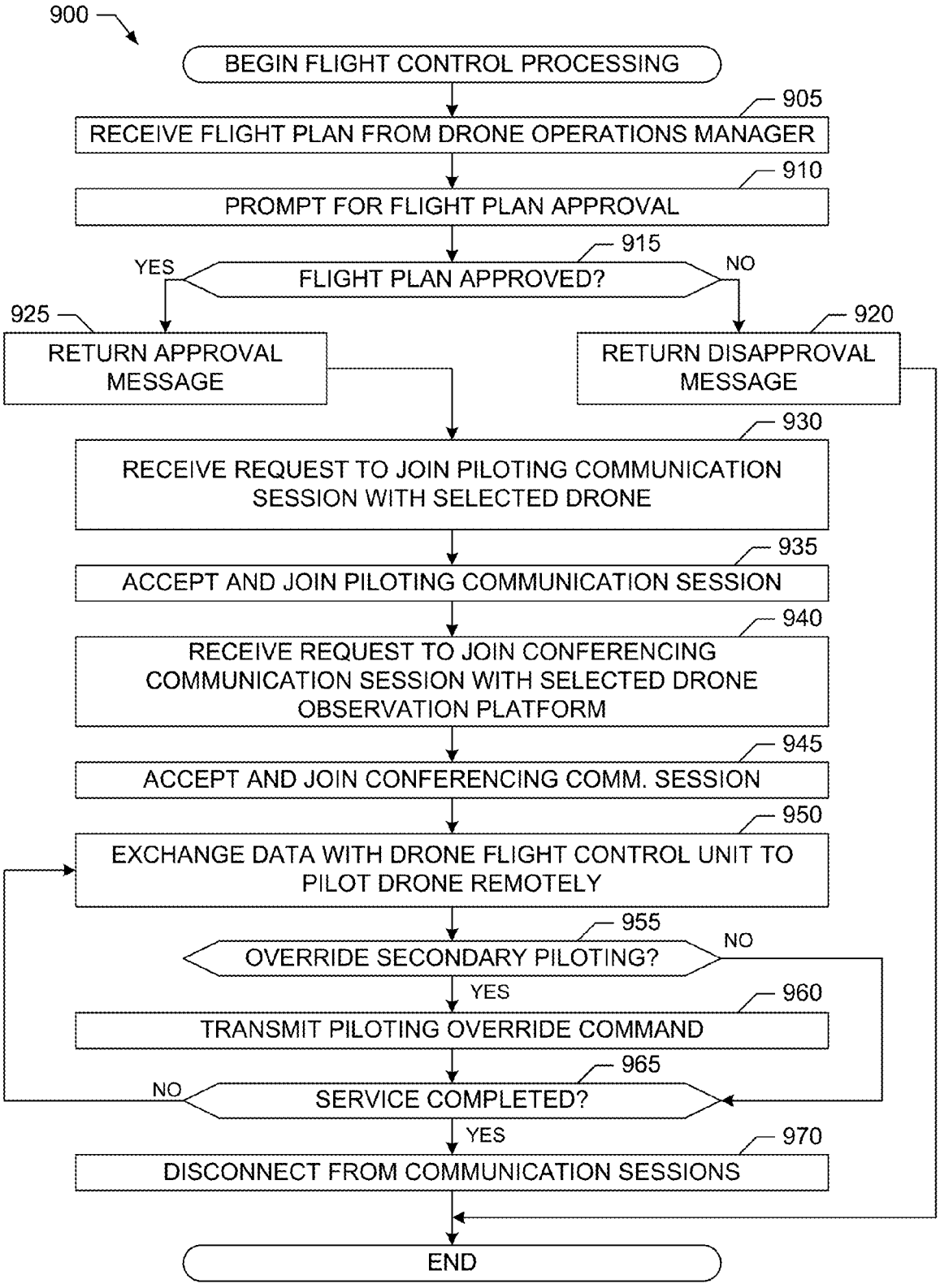

900
BEGIN FLIGHT CONTROL PROCESSING
905
RECEIVE FLIGHT PLAN FROM DRONE OPERATIONS MANAGER
910
PROMPT FOR FLIGHT PLAN APPROVAL
915
YES
FLIGHT PLAN APPROVED?
NO
925
RETURN APPROVAL MESSAGE
920
RETURN DISAPPROVAL MESSAGE
930
RECEIVE REQUEST TO JOIN PILOTING COMMUNICATION SESSION WITH SELECTED DRONE
935
ACCEPT AND JOIN PILOTING COMMUNICATION SESSION
940
RECEIVE REQUEST TO JOIN CONFERENCING COMMUNICATION SESSION WITH SELECTED DRONE OBSERVATION PLATFORM
945
ACCEPT AND JOIN CONFERENCING COMM. SESSION
950
EXCHANGE DATA WITH DRONE FLIGHT CONTROL UNIT TO PILOT DRONE REMOTELY
955
OVERRIDE SECONDARY PILOTING?
NO
YES
960
TRANSMIT PILOTING OVERRIDE COMMAND
965
NO
SERVICE COMPLETED?
YES
970
DISCONNECT FROM COMMUNICATION SESSIONS
END

FIG. 9

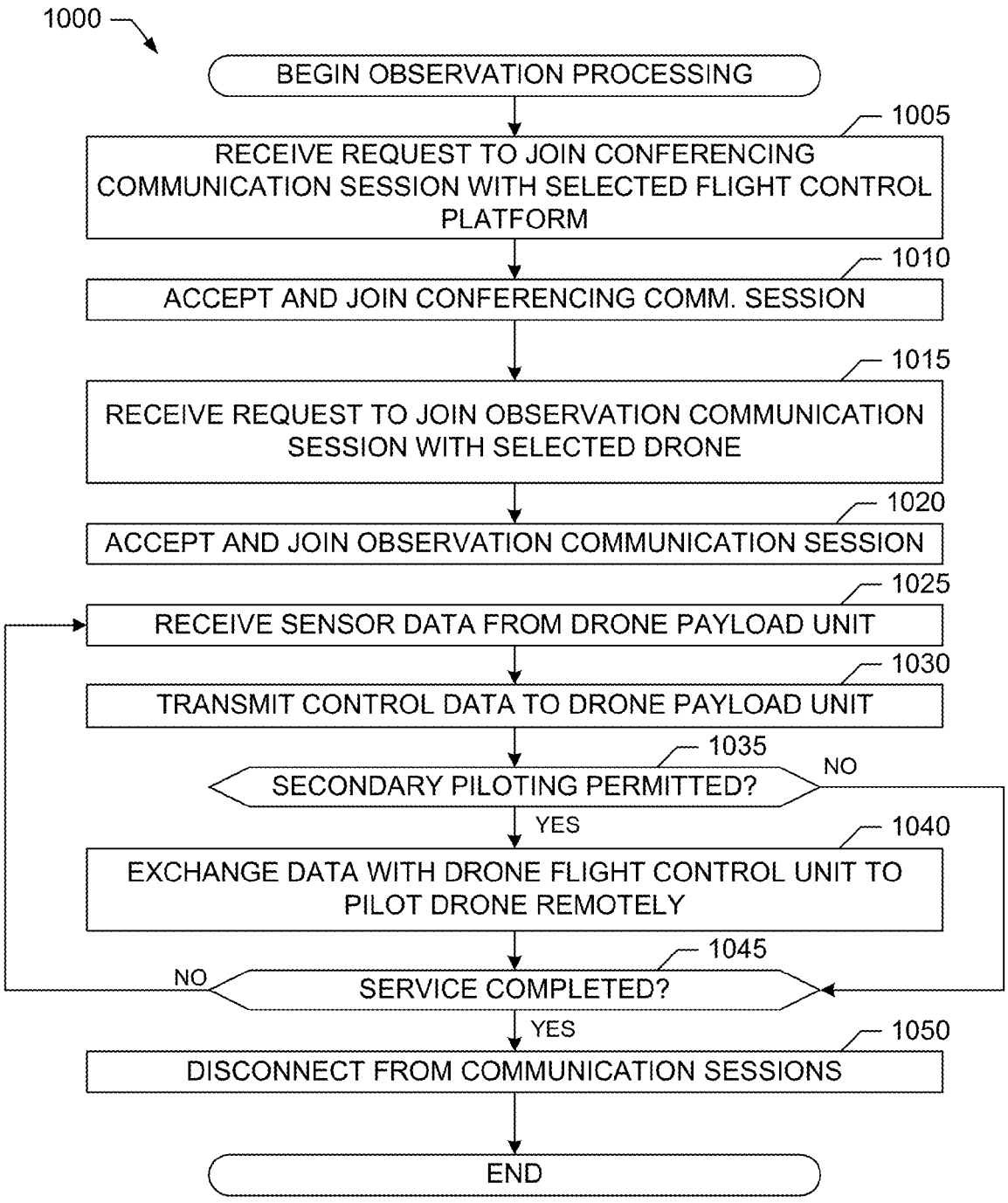
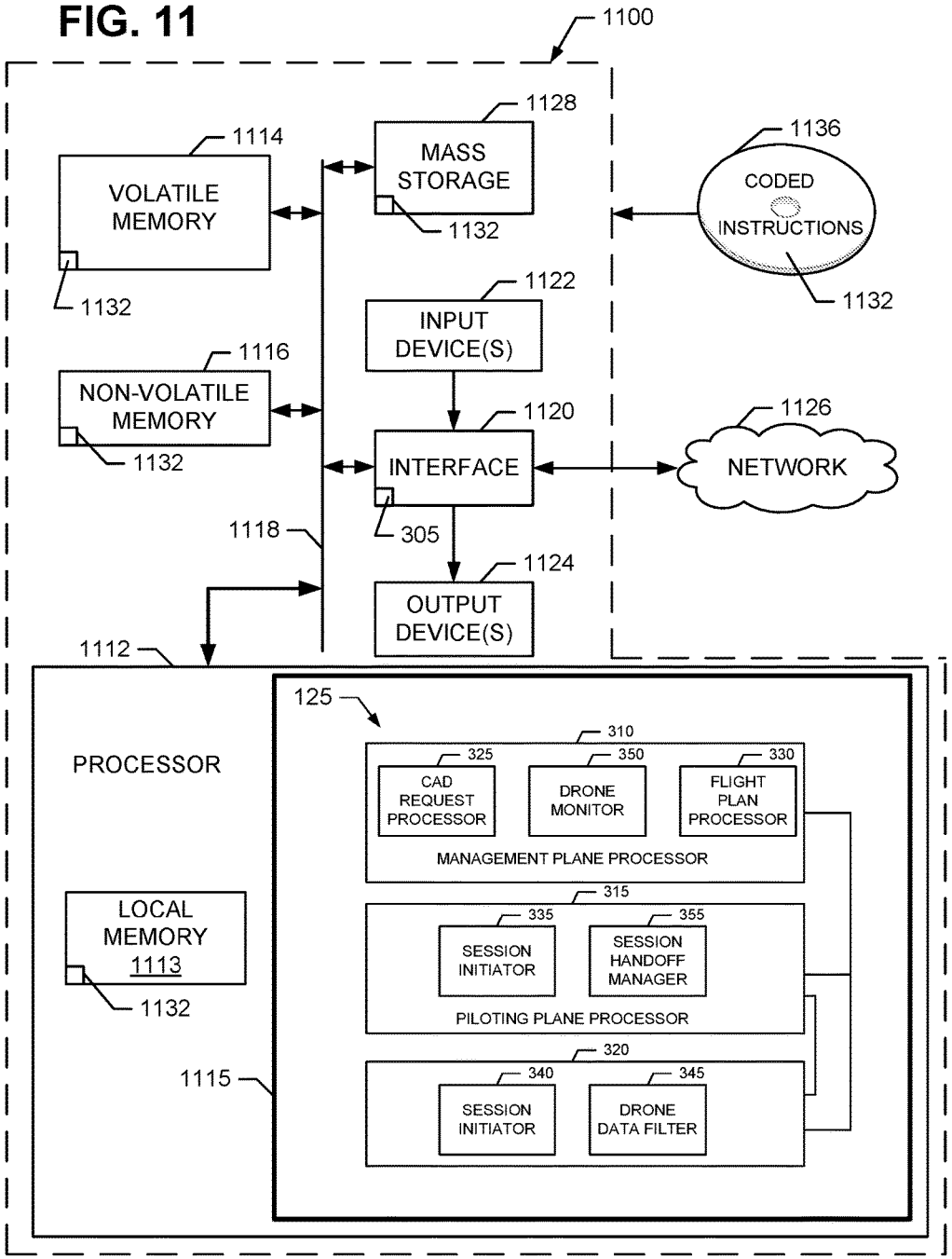

1000
BEGIN OBSERVATION PROCESSING
1005
RECEIVE REQUEST TO JOIN CONFERENCING COMMUNICATION SESSION WITH SELECTED FLIGHT CONTROL PLATFORM
1010
ACCEPT AND JOIN CONFERENCING COMM. SESSION
1015
RECEIVE REQUEST TO JOIN OBSERVATION COMMUNICATION SESSION WITH SELECTED DRONE
1020
ACCEPT AND JOIN OBSERVATION COMMUNICATION SESSION
1025
RECEIVE SENSOR DATA FROM DRONE PAYLOAD UNIT
1030
TRANSMIT CONTROL DATA TO DRONE PAYLOAD UNIT
1035
SECONDARY PILOTING PERMITTED?
NO
YES
1040
EXCHANGE DATA WITH DRONE FLIGHT CONTROL UNIT TO PILOT DRONE REMOTELY
1045
NO
SERVICE COMPLETED?
YES
1050
DISCONNECT FROM COMMUNICATION SESSIONS
END

FIG. 10

FIG. 11


1100
1128
MASS STORAGE
1132
1114
VOLATILE MEMORY
1132
1136
CODED INSTRUCTIONS
1132
1122
INPUT DEVICE(S)
1116
NON-VOLATILE MEMORY
1132
1120
INTERFACE
305
1126
NETWORK
1118
1124
OUTPUT DEVICE(S)
1112
PROCESSOR
125
310
325
CAD REQUEST PROCESSOR
350
DRONE MONITOR
330
FLIGHT PLAN PROCESSOR
MANAGEMENT PLANE PROCESSOR
315
335
SESSION INITIATOR
355
SESSION HANDOFF MANAGER
PILOTING PLANE PROCESSOR
320
340
SESSION INITIATOR
345
DRONE DATA FILTER
LOCAL MEMORY 1113
1132
1115

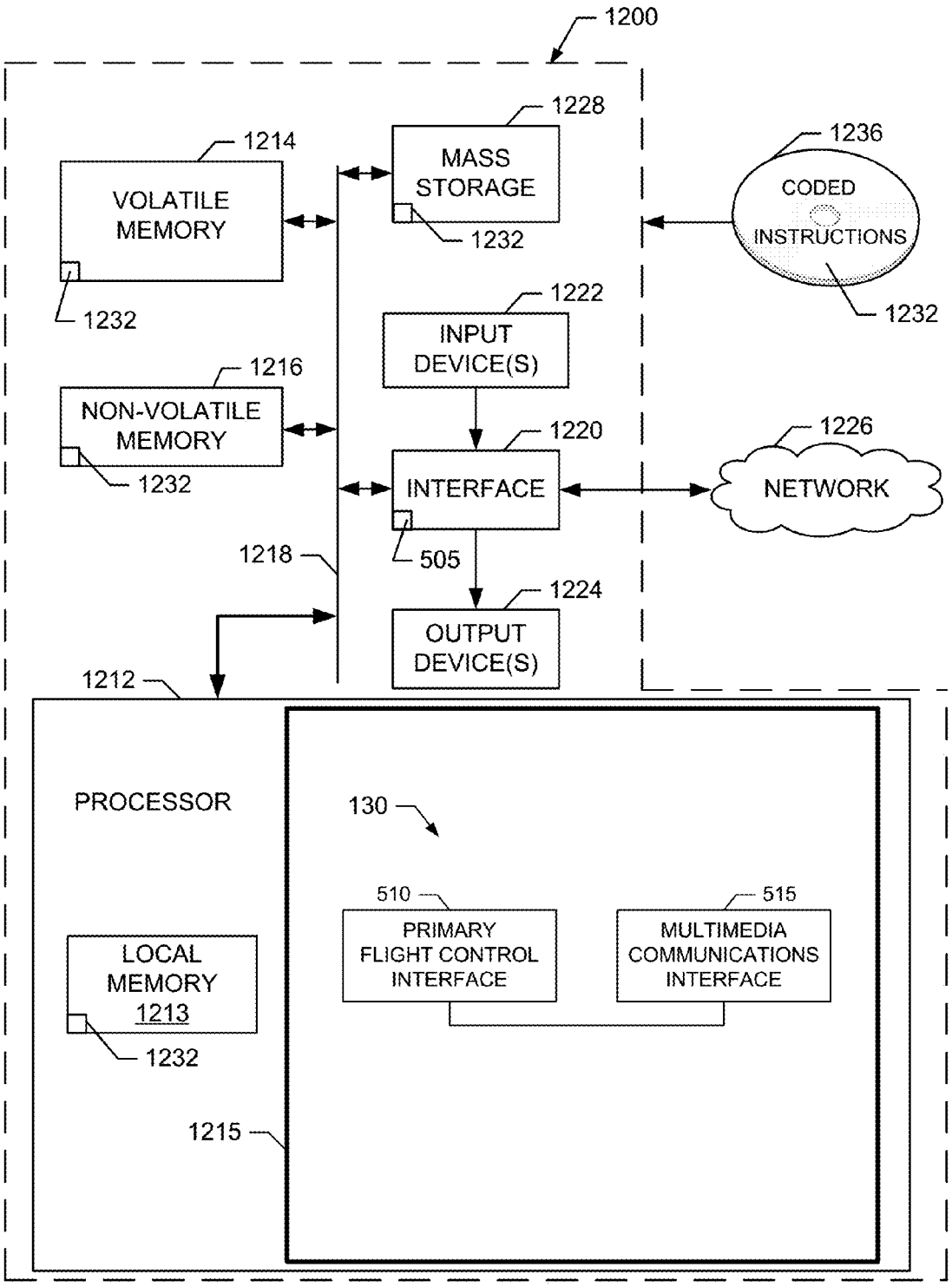

1200
1228
1214
MASS STORAGE
1236
VOLATILE MEMORY
CODED INSTRUCTIONS
1232
1232
1232
1222
INPUT DEVICE(S)
1216
NON-VOLATILE MEMORY
1220
1226
1232
INTERFACE
NETWORK
1218
505
1224
OUTPUT DEVICE(S)
1212
PROCESSOR
130
510
515
PRIMARY FLIGHT CONTROL INTERFACE
MULTIMEDIA COMMUNICATIONS INTERFACE
LOCAL MEMORY 1213
1232
1215

FIG. 12

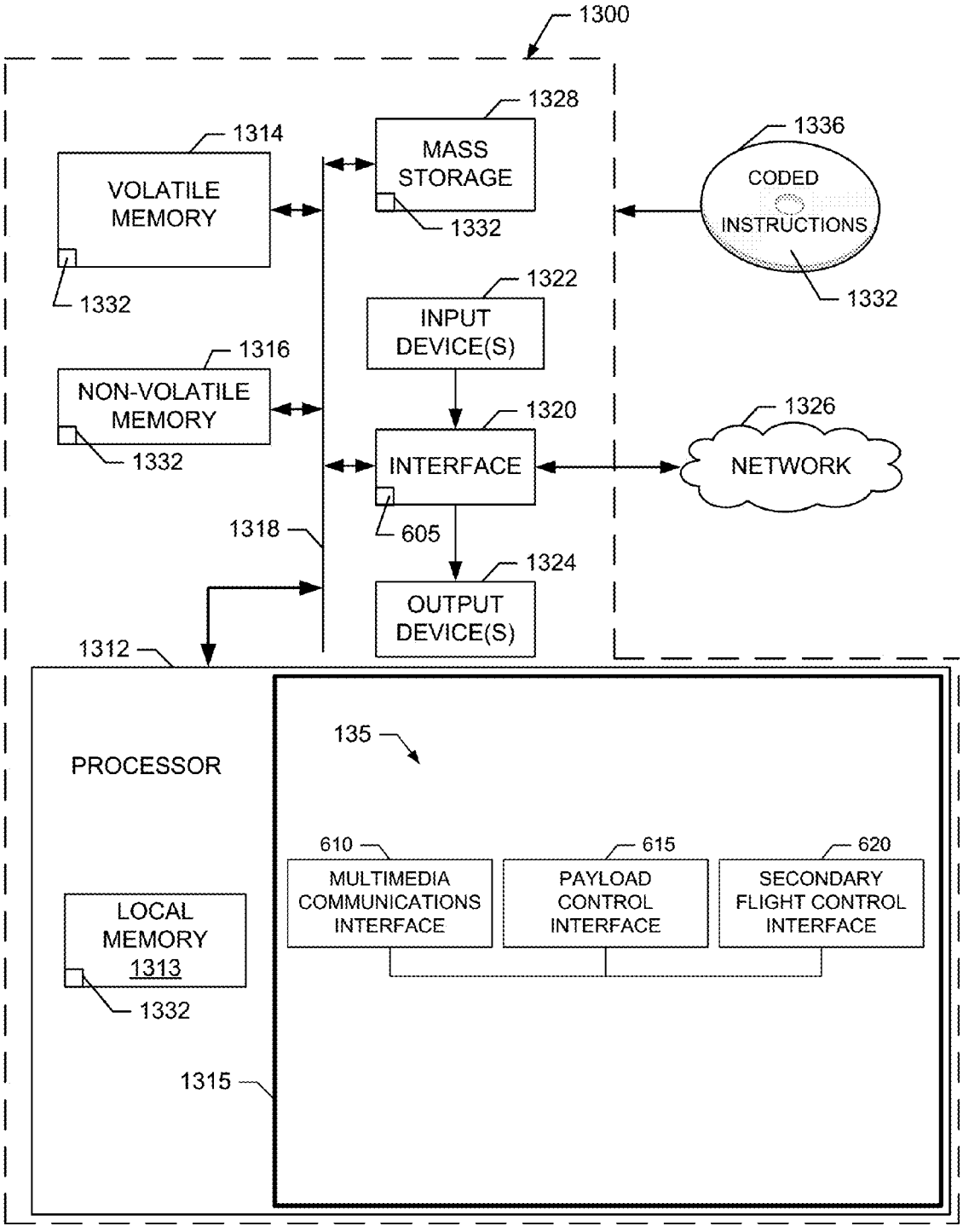

1300
1328
MASS STORAGE
1332
1314
VOLATILE MEMORY
1332
1336
CODED INSTRUCTIONS
1332
1322
INPUT DEVICE(S)
1316
NON-VOLATILE MEMORY
1332
1320
INTERFACE
605
1326
NETWORK
1318
1324
OUTPUT DEVICE(S)
1312
PROCESSOR
135
610
MULTIMEDIA COMMUNICATIONS INTERFACE
615
PAYLOAD CONTROL INTERFACE
620
SECONDARY FLIGHT CONTROL INTERFACE
LOCAL MEMORY 1313
1332
1315

FIG. 13

COMPUTER AIDED DISPATCH OF DRONES

FIELD OF THE DISCLOSURE

This disclosure relates generally to drones and, more particularly, to computer aided dispatch of drones.

BACKGROUND

Drones, such as unmanned aerial vehicles (UAVs), are mobile platforms capable of acquiring (e.g., sensing) information, delivering materials, manipulating objects, etc., in many operating scenarios. For example, drones can travel quickly, and without the physical limitations of ground based transport, to locations that are remote, dangerous, unable to be reached by human personnel, etc., or any combination thereof. Upon reaching such locations, drones can provide many benefits, such as acquiring sensor data (e.g., audio, image, video and/or other sensor data) at a target location, delivering materials (e.g., medical supplies, food supplies, engineering materials, etc.) to the target location, manipulating objects (e.g., such as retrieving objects, operating equipment, etc.) at the target location, etc. However, drone operation, such as drone piloting over extended distances, may require a pilot with special training. Furthermore, in some scenarios, drone operation may be restricted to a certified pilot who has submitted a flight plan to a relevant governmental agency and/or other appropriate organization.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of an example drone operations system supporting computer-aided dispatch of drones in accordance with the teachings of this disclosure.

FIG. **2** illustrates example drone processing planes supported by the example drone operations system of FIG. **1**.

FIG. **3** is a block diagram of an example drone operations manager that may be used to implement the example drone operations system of FIG. **1**.

FIG. **4** illustrates example communications sessions initiated by the example drone operations manager of FIG. **3** to dispatch drones in the example drone operations system of FIG. **1** in accordance with the teachings of this disclosure

FIG. **5** is a block diagram of an example flight control platform that may be used to implement the example drone operations system of FIG. **1**.

FIG. **6** is a block diagram of an example drone observation platform that may be used to implement the example drone operations system of FIG. **1**.

FIGS. **7**A-B and **8** are flowcharts representative of example machine readable instructions that may be executed to implement the example drone operations manager of FIG. **3**.

FIG. **9** is a flowchart representative of example machine readable instructions that may be executed to implement the example flight control platform of FIG. **5**.

FIG. **10** is a flowchart representative of example machine readable instructions that may be executed to implement the example drone observation platform of FIG. **6**.

FIG. **11** is a block diagram of an example processor platform structured to execute the example machine readable instructions of FIGS. **7**A-B and/or **8** to implement the example drone operations manager of FIG. **3**.

FIG. **12** is a block diagram of an example processor platform structured to execute the example machine readable instructions of FIG. **9** to implement the example flight control platform of FIG. **5**.

FIG. **13** is a block diagram of an example processor platform structured to execute the example machine readable instructions of FIG. **10** to implement the example drone observation platform of FIG. **6**.

The figures are not to scale. Wherever possible, the same reference numbers will be used throughout the drawing(s) and accompanying written description to refer to the same or like parts, elements, etc.

DETAILED DESCRIPTION

Methods, apparatus, systems and articles of manufacture (e.g., physical storage media) to implement computer aided dispatch of drones are disclosed herein. Example drone dispatching methods disclosed herein include transmitting a flight plan for a drone to a flight control platform (e.g., associated with a drone pilot). In some examples, the flight plan is based on a first location associated with a service request. Disclosed example methods also include, in response to receiving a message from the flight control platform indicating the flight plan is approved, initiating a first communication session (e.g., a piloting communications session, as described in further detail below) between the flight control platform and a flight control unit of the drone to permit remote piloting of the drone. Disclosed example methods further include, in response to receiving the message from the flight control platform indicating the flight plan is approved, initiating a second communication session (e.g., a conferencing communication session, as described in further detail below) to exchange communication session data, such as multimedia data, between the flight control platform and a drone observation platform (e.g., associated with a subject matter expert), with the drone observation platform being separate from the flight control platform.

Some disclosed example methods further include initiating a third communication session (e.g., an observation communication session, as disclosed in further detail below) between the drone observation platform and a payload unit of the drone. In some such examples, the third communication session is to convey sensor data from the payload unit to the drone observation platform, and is to further convey control data from the drone observation platform to the payload unit to control operation of the payload unit. Some such disclosed example methods also include blocking data from being exchanged between the drone observation platform and the flight control unit of the drone via the third communication session to prevent the remote piloting of the drone via the drone observation platform. Some such disclosed example methods further include activating the blocking of data from being exchanged between the drone observation platform and the flight control unit of the drone via the third communication session in response to a command (e.g., an override command) received from the flight control platform.

Additionally or alternatively, some disclosed example methods further include adding another communication device to the second communication session to exchange at least a portion of the multimedia among the flight control platform, drone observation platform and the communication device.

Additionally or alternatively, in some disclosed example methods, the multimedia data exchanged between the flight control platform and the drone observation platform via the second communication session includes voice data exchanged between the flight control platform and the drone observation platform, and graphical data transmitted from

the flight control platform to the drone observation platform. In some such examples, the graphical data is based on sensor data received by the flight control platform from a payload unit of the drone via the first communication session.

Additionally or alternatively, in some disclosed examples, the drone is a first drone included in a fleet of drones and the first drone is located at a second location. Some such disclosed example methods further include receiving the service request from a computer aided dispatch system, with the service request identifying the first location and including descriptive information. Some such disclosed example methods also include selecting the first drone from the fleet of drones based on the descriptive information and a distance between the first location and the second location, and invoking a mapping application to determine the flight plan to route the first drone from the second location to the first location. In examples in which the drone observation platform is a first drone observation platform from among multiple different observation platforms (e.g., associated with different subject matter experts), some such disclosed example methods further include selecting the first drone observation from the multiple different observation platforms based on the descriptive information included in the service request.

Additionally or alternatively, some such disclosed example methods further include, in response to receiving the message from the flight control platform indicating the flight plan is approved, transmitting the flight plan to a computing platform associated with a governmental agency.

These and other example methods, apparatus, systems and articles of manufacture (e.g., physical storage media) to implement computer aided dispatch of drones are disclosed in greater detail below.

Drones, such as UAVs, have the capability to provide many benefits in many different possible scenarios. As noted above, drones have the potential to acquire sensor data (e.g., audio, image, video and/or other sensor data), deliver materials (e.g., medical supplies, food supplies, engineering materials, etc.), manipulate objects (e.g., such as retrieving objects, operating equipment, etc.), etc., in locations that are remote, dangerous, unable to be reached by human personnel, etc. However, in at least some scenarios, drone operation may be restricted to a pilot with special training, or even a certified pilot who has submitted a flight plan to a relevant governmental agency and/or other appropriate organization. For example, some jurisdictions may require drones being flown outside a small operational window (e.g., a small area, such as a Wi-Fi region or Wi-Fi bubble) to be flown by a pilot certified by a governmental agency (such as the Federal Aviation Administration (FAA) in the United States) or some other appropriate regulating body, and under a flight plan submitted to the agency before drone operations begin. Currently, in emergency response and other time critical situations, the logistics associated with contacting a certified pilot and submitting a flight plan may not be able to be completed within the desired response time window (e.g., such as five (5) minutes for emergency response scenarios), or the cost of completing such logistics within the desired response time window may be prohibitive. Furthermore, finding a drone pilot who also has the subject matter expertise appropriate for the actual situation (such as a pilot who is also a firefighter, a pilot who is also a police officer, a pilot who is also a network technician, etc.) is rare, further limiting the viability of using drones for time-critical response scenarios.

Example methods, apparatus, systems and articles of manufacture (e.g., physical storage media) disclosed herein provide technical solutions to the technical problems associated with using drones in time-critical response scenarios by providing platforms to integrate drone management with computer aided dispatch systems. Example drone deployment systems implementing computer aided dispatch of drones in accordance with the teachings of this disclosure utilize one or more communication networks and/or services to implement (i) a drone piloting plane to permit remote piloting of drones, (ii) a drone management plane to support drone selection, configuration, flight plan creation, etc., and (iii) a drone interaction plane to allow one or more subject matter experts and/or on-scene personnel to view and/or interact with drone sensor feeds, interact with the drone pilot, interact among each other, etc. Some example drone deployment systems disclosed herein implement the drone pilot plane, the drone management plane and the drone interaction plane as parallel processes that are invoked in response to a service request to dispatch resources received from a computer aided dispatch system, such as a request to dispatch emergency personnel.

For example, an example drone deployment system implementing computer aided dispatch of drones in accordance with the teachings of this disclosure responds to a service request from a computer aided dispatch platform by invoking the drone management plane to select a drone from a fleet of available drones based on a target location and descriptive information provided in the service request. The example drone management plane also prepares a flight plan for the drone based on the target location provided in the service request and capability information specified for the selected drone. The example drone management plane further transmits the flight plan to a flight control platform associated with a pilot (who may be selected from a group of available pilots) to obtain approval of the flight plan.

In some examples, in response to a message from the flight control platform indicating approval of the flight plan, the drone management plane electronically submits the approved flight plan to the appropriate governmental agency and/or regulating body. Additionally, the example drone deployment system invokes the drone piloting plane to initiate a piloting communication session between the pilot's flight control platform and the selected drone to enable remote piloting of the drone by the selected pilot. Furthermore, in some examples, the drone deployment system invokes the drone interaction plane (e.g., in parallel with invocation of the drone piloting plan) to initiate a conferencing communication session between the flight control platform of the selected pilot and a drone observation platform of a subject matter expert (who may be selected from a group of available subject matter experts based on descriptive information included in the service request). The conferencing communication session permits multimedia data, such as voice and/or video data, to be exchanged between the subject matter expert and the drone pilot in real-time, such that the subject matter expert can direct the pilot's operation of the drone. Furthermore, in some examples, the conferencing communication session can permit multimedia data, such as graphical data generated by the flight control platform from sensor data (e.g., video data, temperature data, etc.) received from the drone, to be transmitted from the flight control platform to the drone observation platform. In some examples, the drone deployment system monitors the conferencing communication session to, for example, add communication device(s) to the conferencing communication session to permit on-site personnel to communicate with the subject matter expert and/or the drone pilot.

In some examples, the drone interaction plane also initiates an observation communication session between the drone observation platform of a subject matter expert and the selected drone to permit the drone observation platform to, for example, receive sensor data from the drone. Additionally or alternatively, the observation communication session may permit the drone observation platform to transmit control data to the drone to control operation of, for example, sensor(s) and/or other equipment (e.g., tools, object manipulators, etc.) carried by the drone. In some examples, the drone deployment system blocks (e.g., permanently, selectively, etc.) flight control data from being exchanged between the drone observation platform and the drone to prevent the drone observation platform from being used to remotely pilot the drone.

Through the foregoing drone deployment mechanisms, example drone deployment systems disclosed herein do not rely on drone pilots having the requisite subject matter expertise for a given scenario. Instead, disclosed example drone deployment systems permit drone pilots to be paired with personnel having the requisite subject matter expertise in real-time and potentially at different locations. Furthermore, disclosed example drone deployment systems handle logistics, such as drone selection, pilot selection, subject matter expert selection, flight plan generation and submission, etc., automatically and electronically in a time-efficient manner, thereby allowing response times to be met in time critical scenarios.

Turning to the figures, a block diagram of an example drone deployment system **100** implementing computer-aided dispatch of drones in accordance with the teachings of this disclosure is illustrated in FIG. **1**. The example drone deployment system **100** includes a fleet of one or more example drones **105**A-C. Respective ones of the example drones **105**A-C may be implemented by, for example, any type of drone, such as an unmanned aerial vehicle (UAV), etc., and/or other vehicular device, such as an unmanned vehicular device, a robotic device, etc., that is a ground vehicle, a water craft, etc. In the illustrated example of FIG. **1**, the drones **105**A-C are depicted as UAVs and include respective flight control units and payload units. For example, the drone **105**A includes an example flight control unit **110**A and an example payload unit **115**A.

In the illustrated example, the example flight control unit **110**A includes any appropriate avionics, control actuators, and/or other equipment to fly the drone **105**A, and one or more communication transceivers to receive flight control commands from and transmit feedback and/or other sensor data to one or more remote platforms to permit remote piloting of the drone **105**A. The payload unit **115**A of the illustrated example includes one or more sensors, such as one or more cameras and/or other imaging sensor, one or more microphones and/or other acoustic sensors, one or more environmental sensors (e.g., such as one or more temperature sensors, pressure sensors, humidity sensors, gas sensors, etc.), etc., or any combination thereof. Additionally or alternatively, the example payload unit **115**A includes equipment, such as one or more tools, actuators, manipulators, etc., capable of manipulating (e.g., touching, grasping, delivering, measuring, etc.) objects. The payload unit **115**A further includes one or more communication transceivers to transmit sensor data to one or more remote platforms, and/or receive payload control commands from one or more remote platforms to permit remote operation of the payload equipment.

In some examples, the flight control unit **110**A and the payload unit **115**A of the example drone **105**A share the same communication transceiver(s). In some examples, the flight control unit **110**A and the payload unit **115**A of the example drone **105**A additionally or alternatively include separate communication transceiver(s). The example communication transceiver(s) of the flight control unit **110**A and/or the payload unit **115**A of the drone **105**A can be implemented by any type(s), number(s) and/or combination(s) of communication transceivers. For example, the example communication transceiver(s) of the flight control unit **110**A and/or the payload unit **115**A of the drone **105**A can be implemented by one or more transceivers supporting one or more third generation (3G) and/or fourth generation (4G) mobile cellular communication standards, and/or one or more transceivers supporting WiFi communications, satellite communications, ultra-low frequency (ULF) communications, etc., or any combination thereof.

The example drone deployment system **100** of FIG. **1** also includes example docking stations **120**B-C for the example drones **105**A-C. For example, two such example docking stations **120**B-C are illustrated in the example of FIG. **1**. The example docking stations **120**B-C are structured to recharge and/or otherwise support the drones **105**A-C.

To implement computer aided dispatch of drones in accordance with the teachings of this disclosure, the example drone deployment system **100** includes (i) an example drone operations manager **125** in communication with the drones **105**A-C, (ii) one or more flight control platforms, such as an example flight control platform **130**, and (iii) one or more drone observation platforms, such as an example drone observation platforms **135**A-C. As used herein, the phrase "in communication," including variances thereof, encompasses direct communication and/or indirect communication through one or more intermediary components and does not require direct physical (e.g., wired) communication and/or constant communication, but rather additionally includes selective communication at periodic or aperiodic intervals, as well as one-time events.

In the illustrated example of FIG. **1**, the drone operations manager **125** is implemented by one or more cloud services accessible to the example drones **105**A-C, the example flight control platform **130**, and the example drone observation platforms **135**A-C via an example network **140**. However, the example drone deployment system **100** is not limited thereto. For example, the drone operations manager **125** can be implemented by one or more processing platforms, one or more servers, one or more computing devices, etc., as disclosed in further detail below. The example network **140** of the drone deployment system **100** may be implemented by any type(s), number(s) and/or combination(s) of networks, such as one or more 3G and/or 4G mobile carrier networks, one or more WiFi networks, one or more satellite networks, one or more carrier telecommunications networks, one or more broadband networks, etc.

As disclosed in further detail below, the drone operations manager **125** dispatches drones in response to service requests received from requestors, such as an example computer aided dispatch system **145**, via the example network **140**. The example computer aided dispatch system **145** can be implemented by any type(s) and/or number of dispatch systems associated with, for example, an emergency services dispatch system, a network maintenance dispatch system, etc. In the illustrated example of FIG. **1**, in response to a service request received from the computer aided dispatch system **145**, the drone operations manager **125** processes information included in the request to select a drone, such as the example drone **105**A, from the fleet of drones to support the request. The drone operations manager

125 also selects, based on information included in the request, a flight control platform, such as the flight control platform 130, associated with a pilot, and a drone observation platform, such as the drone observation platform 135A, associated with a subject matter expert (SME). The drone operations manager 125 further determines a flight plan for piloting the selected drone 105A to an example target location 150 identified in the service request.

After determining the flight plan, the drone operations manager 125 transmits the flight plan via the example network 140 to the selected flight control platform 130 to obtain approval of the flight plan. In response to a reply message received from the flight control platform 130 approving the flight plan, the drone operations manager 125 initiates a first communication session between the selected flight control platform 130 and the selected drone 105A to permit the drone to be remotely piloted by the flight control platform 130. For example, the network 140 may include an example wireless network 155, such as a 3G/4G mobile carrier network, a WiFi network, a satellite network, etc., or any combination thereof, capable of exchanging data with the communication transceiver(s) of the drone 105A.

In the illustrated example of FIG. 1, in response to the reply message received from the flight control platform 130 approving the flight plan, the drone operations manager 125 also initiates a second communication session between the selected flight control platform 130 and the selected drone observation platform 135A via the network 140 to permit multimedia data (e.g., such as voice data, video data, text data, etc.) to be exchanged between the flight control platform 130 and the drone operations manager 125. In some examples, the drone operations manager 125 also permits one or more communication devices, such as the example communications devices 160A-B illustrated in FIG. 1, associated with one or more personnel, such as on-site personnel at the target location 150, to be added to the second communication session.

In the illustrated example of FIG. 1, in response to the reply message received from the flight control platform 130 approving the flight plan, the drone operations manager 125 further initiates a third communication session between the selected drone observation platform 135A and the selected drone 105A to permit the drone observation platform 135A to access the payload unit 115A of the drone 105A. For example, the third communication session can permit the drone observation platform 135A to receive sensor data from the payload unit 115A and/or transmit commands to control the sensor(s) and/or other equipment included in the payload unit 115A. In some examples, the third communications session allows the drone observation platform 135A to remotely pilot the drone 105A. In some such examples, the drone observation platform 135A operates as a secondary piloting platform, which is subordinate to and can be overridden by commands from the selected flight control platform 130 (which, therefore, operates as a primary piloting platform).

In some examples, the drone operations manager 125 of FIG. 1 configures the deployed drone 105A to perform one or more autonomous (or semi-autonomous) protection routines while traveling to and/or operating at the target location 150. For example, the drone operations manager 125 may configure the drone 105A to perform an object avoidance procedure to avoid objects, such as power lines, structures, interior walls, animals, people, etc., if the drone 105A is equipped with one or more sensors capable of detecting objects, such as one or more radar sensors, ultrasonic sensors, inductance sensors, etc. Additionally or alternatively, the drone operations manager 125 may configure the drone 105A to perform a hazard avoidance procedure to avoid hazards, such a fire, smoke, water, etc., if the drone 105A is equipped with one or more sensors capable of detecting hazards, such as one or more thermal sensors, smoke sensors, acoustic sensors, etc. Additionally or alternatively, the drone operations manager 125 may configure the drone 105A to perform a personnel protection procedure, which causes the drone 105A to vary its position randomly when operating at the target location 150 to protect the locations of personnel from being detected (e.g., tagged) due to drone operation.

The example drone operations manager 125 of FIG. 1 implements multiple processing planes to perform the example operations described above and in further detail below to provide computer aided dispatch of drones in accordance with the teachings of this disclosure. Example processing planes 200 implemented by the example drone operations manager 125 of FIG. 1 are illustrated in FIG. 2. With reference to FIG. 2, the example processing planes implemented by the example drone operations manager 125 of FIG. 1 include an example drone management plane 205, an example drone piloting plane 210 and an example drone interaction plane 215. As illustrated in FIG. 2, the example drone management plane 205 includes processing to perform drone selection, flight plan creation and registration, flight control platform selection, drone observation platform selection, drone operation monitoring, etc. The example drone piloting plane 210 includes processing to permit a pilot associated with a flight control platform (e.g., such as the example flight control platform 130) to remotely pilot the flight control units of the example drones 105A-C (e.g., such as the example flight control unit 110A of the example drone 105A). The example drone interaction plane 215 includes processing to permit interaction(s) between the flight control platform of the drone pilot and one or more drone observation platforms (e.g., such as the example drone observation platforms 135A-C) associated with one or more subject matter experts (SMEs). In some examples, the example drone interaction plane 215 also permits interaction (s) between the drone observation platforms of the SME(s) and the payload units of the example drones 105A-C (e.g., such as the example payload unit 115A of the example drone 105A). In some examples, the example drone interaction plane 215 additionally or alternatively permits interaction(s) between communication device(s) (e.g., such as the example communication devices 160A-B) associated with on-site personnel and the drone observation platforms associated with the SMEs and/or the flight control platform associated with the drone pilot. Furthermore, in some examples, the drone interaction plane 215 permits secondary remote piloting of the flight control units of the example drones 105A-C from the drone observation platforms (e.g., with primary remote piloting being performed by the flight control platform associated with the drone pilot).

An example implementation of the drone operations manager 125 of FIG. 1, which supports the example processing planes 200 of FIG. 2, is illustrated in FIG. 3. The processing performed by the example drone operations manager 125 of FIG. 3 includes the initiation of several communication sessions in the example drone deployment system 100 to support drone deployment in accordance with the teachings of this disclosure. Examples of these different communication sessions are illustrated in FIG. 4, which is described in further detail below.

With reference to the example processing planes illustrated in FIG. 2, the example drone operations manager 125

of FIG. **3** includes an example network interface **305** to communicate with one or more communication networks, links, etc., such as the example network **140** of FIG. **1**. The example network interface **305** can be implemented by any type(s), number(s) and/or combination(s) of interfaces, such as the example interface circuit **1120** of FIG. **11**, which is described in further detail below. In the illustrated example of FIG. **3**, the network interface **305** receives service requests from computer aided dispatch (CAD) systems, such as the example CAD system **145** of FIG. **1**, via the network **140**. For example, once the example CAD system **145** identifies a target location, such as the example target location **150**, to which a drone is to be dispatched, the CAD system **145** sends a service request including information identifying the target location to the drone operations manager **125** via the network **140**, which is received by the example network interface **305**.

The example drone operations manager **125** of FIG. **3** also includes an example management plane processor **310**, an example piloting plane processor **315** and an example interaction plane processor **320** to implement the example drone management plane **205**, the example drone piloting plane **210** and the example drone interaction plane **215**, respectively, of FIG. **2** in the example drone deployment system **100** of FIG. **1**. In the illustrated example of FIG. **3**, the management plane processor **310** of the example drone operations manager **125** includes an example CAD request processor **325** to process service requests received from CAD systems, such as the example CAD system **145** of FIG. **1**. For example, in response to a service request received from the CAD system **145**, the drone operations manager **125** invokes the CAD request processor **325** of the management plane processor **310** to review the inventory of available drones **105**A-C, calculate respective distances and/or travel times for the different drones **105**A-C from their respective staging locations (e.g., such as the locations of the example docking stations **120**B-C) to the target location **150** (e.g., by invoking one or more automated mapping applications), and retrieve the operational capabilities (e.g., operational range and duration, etc.) of the different drones **105**A-C. The CAD request processor **325** then evaluates the calculated distances, travel times and/or operational capabilities to select one or more of the drones to support the service request from the CAD system **145** (or none if no drones are available). For example, the CAD request processor **325** may select one of the available drones **105**A-C that has the lowest calculated travel time and/or distance to the target location **150**, and/or that has a calculated travel time that satisfies (e.g., is within) a first threshold window of time (e.g., 5 minutes or some other time window), and that has an operational range and duration to travel to the target location **150** and remain there for at least a second threshold window of time (e.g., 30 minutes, 1 hour, or some other window of time).

In some examples, the service request received from the CAD system **145** also includes descriptive information specifying the type of service request. For example, such descriptive information for an emergency services request may specify whether the service request is for a medical emergency, a structural fire, a forest fire, a natural disaster, etc. As another example, descriptive information included in a maintenance service request may specify whether the request is for structural/equipment monitoring, material delivery, remote exploration, etc. In some such examples, the operational capabilities retrieved by the CAD request processor **325** for the different drones **105**A-C may also include drone configuration information specifying the payload unit characteristics of the different drones. For example, such drone configuration information may specify the available sensors, such as camera types, audio capability, etc., supported by the different drones **105**A-C, the available object manipulation equipment, such as tools, actuators, etc., carried by the different drones **105**A-C, etc. In some such examples, the CAD request processor **325** further evaluates the drone configuration information for the different drones **105**A-C, along with evaluating the calculated distances, travel times and/or other operational capabilities determined for the different drones **105**A-C, to select one or more of the drones **105**A-C to support the service request received from the CAD system **145**. For example, the CAD request processor **325** may perform a first selection procedure to select one or more of the drones **105**A-C having payload unit characteristics capable of supporting the type of service request to be included in a candidate subset of drones. The CAD request processor **325** may then perform a second selection procedure to select, based on calculated distances and/or travel times as described above, one or more of the drones **105**A-C included in the candidate subset of drones to support the service request.

The example management plane processor **310** of the example drone operations manager **125** of FIG. **3** also includes an example flight plan processor **330** to determine flight plan(s) for the drone(s) selected by the CAD request processor **325** to support the service request received from the CAD system **145**. For example, assuming the CAD request processor **325** selects the drone **105**A to support the service request, the flight plan processor **330** invokes one or more automated mapping applications to determine a flight plan to convey the drone **105**A from its staging location to the target location **150**. The example flight plan processor **330** further transmits (e.g., via the network interface **305** and the network **140**) the determined flight plan to a flight control platform, such as the flight control platform **130**, of the drone pilot who is to pilot the selected drone **105**A, to request approval of the flight plan. In some examples, the CAD request processor **325** also selects an available drone pilot (or an available flight control platform associated with an available drone pilot) to support the service request received from the CAD system **145**. For example, the CAD request processor **325** may perform round-robin selection to select the next available pilot/flight control platform from a list, and/or may compare pilot/flight control platform qualifications to the descriptive information included in the service request to select an appropriate pilot/flight control platform to support the request.

Assume the example CAD request processor **325** selected the flight control platform **130** to support the service request. Then, in reply to transmitting the flight plan to the selected flight control platform **130**, the flight plan processor **330** receives a reply message (e.g., via the network interface **305** and the network **140**) from the selected flight control platform **130** indicating whether the flight plan is approved. In some examples, if the flight plan is not approved, the flight plan processor **330** determines another flight plan for the selected drone **105**A (e.g., by varying one or more parameters/preferences used by the automating mapping application(s) to determine the flight plan). However, if the flight plan is approved, in some examples the example flight plan processor **330** transmits (e.g., via the network interface **305** and the network **140**) the approved flight plan electronically (e.g., as a data file) to the appropriate government agency (e.g., the FAA) and/or other regulating body, organization, etc.

In the illustrated example of FIG. **3**, the piloting plane processor **315** of the example drone operations manager **125** implements the example drone piloting plane **210** to permit the selected pilot to remotely control operation of the selected drone (e.g., the drone **105**A) via the selected flight control platform (e.g., the flight control platform **130**). For example, assume the drone **105**A and the flight control platform **130** have been selected by the CAD request processor **325** of the management plane processor **310** to support the service request received from the CAD system **145**. In the illustrated example of FIG. **3**, and with reference to FIG. **4**, the piloting plane processor **315** of FIG. **3** includes an example session initiator **335** to initiate an example piloting communication session **405** between the selected flight control platform **130** and the flight control unit **110**A of the selected drone **105**A in response to the drone operations manager **125** receiving a message from the flight control platform **130** indicating approval of the flight plan. In some examples, the piloting communication session **405** is implemented by a virtual private network (VPN) session in a wide area (e.g., mobile cellular and/or WiFi) network, such as the example network **155**, (or a combination of a wide area network and a broadband/telecommunications network) capable of maintaining network communication between the drone **105**A and the flight control platform **130** as the drone is piloted to and operated at the target location **150**. The piloting communication session **405** of the illustrated example supports two-way communications to allow the pilot to enter flight control commands and receive appropriate flight control feedback data (and/or other sensor data) at the flight control platform **130**.

In some examples, the piloting communication session **405** may further provide access to other sensors included in the flight control unit **110**A and/or the example payload unit **115**A of the drone **105**A. For example, the piloting communication session **405** may permit the flight control platform **130** to receive sensor data from one or more drone sensors, such as cameras, microphones, etc., to permit the pilot to visualize and/or otherwise sense operation of the drone **105**A as the drone is flown to and operated at the target location **105**. Furthermore, in some examples, the piloting communication session **405** permits control commands to be sent by the flight control platform **130** to the drone **105**A to permit remote control of sensors and/or other equipment carried by the drone **105**A.

In some examples, the piloting communication session **405** is initiated by the session initiator **335** of the example piloting plane processor **315** prior to deployment of the drone **105**A to permit the pilot to fly the drone **105**A from its staging location to the target location **150**. In some examples, such as when the drone **105**A is able to fly autonomously to one or more checkpoints included in the flight plan, the piloting communication session **405** may be initiated by the session initiator **335** after the drone **105**A is initially deployed and while the drone **105**A is flying to the target location **150** (but before the pilot is to take control of the drone **105**A at the appropriate checkpoint), which may help reduce the overall time involved in deploying the drone **105**A to the target location **150**.

In the example drone operations manager **125** of FIG. **3**, the CAD request processor **325** of the management plane processor **310** also selects one or more available SMEs (or one or more available drone observation platforms associated with the one or more available SMEs) to support the service request received from the CAD system **145**. In some examples, the CAD request selects the SME(s)/drone observation platforms(s) to support the service request in response to the drone operations manager **125** receiving the reply message from the flight control platform **130** indicating approval of the flight plan. For example, the CAD request processor **325** may perform round-robin selection to select the next available SME/drone observation platform from a list, and/or may compare SME/drone observation platform qualifications to the descriptive information included in the service request to select an appropriate SME/drone observation platform to support the request.

In the illustrated example of FIG. **3**, the interaction plane processor **320** of the example drone operations manager **125** implements the example drone interaction plane **215** to permit the selected SME to interact with the selected drone pilot and with at least the payload unit of the selected drone (e.g., the drone **105**A) via the selected drone observation platform (e.g., the drone observation platform **135**A). For example, assume the drone **105**A, the flight control platform **130** and the drone observation platform **135**A have been selected by the CAD request processor **325** of the management plane processor **310** to support the service request received from the CAD system **145**. In the illustrated example of FIG. **3**, and with reference to FIG. **4**, the interaction plane processor **320** of FIG. **3** includes an example session initiator **340** to initiate, via the example network **140**, an example conferencing communication session **410** between the selected drone observation platform **135**A and the selected flight control platform **130**, which may be remotely located from each other, in response to the drone operations manager **125** receiving the reply message from the flight control platform **130** indicating approval of the flight plan. In some examples, the conferencing communication session **410** permits multimedia data, such as voice and/or video data, to be exchanged between the drone observation platform **135**A and the selected flight control platform **130** to enable the selected SME to interact with the selected drone pilot in real-time, such that the subject matter expert can direct the pilot's operation of the drone. For example, the conferencing communication session **410** may be implemented by a video teleconferencing session, an audio teleconferencing session, etc. In some examples, the conferencing communication session **410** is maintained as a separate communication session from the piloting communication session **405** to keep remote control of the drone secure.

In some examples, the conferencing communication session **410** permits graphical data and/or other data determined by the selected flight control platform **130** (e.g., from sensor data received from the drone **105**A) to be transmitted to the selected drone observation platform **135**A. For example, the conferencing communication session **410** may permit screen sharing such that graphical data generated by the flight control platform **130** from sensor data (e.g., video data, temperature data, etc.) received from the drone **105**A can be shared with the drone observation platform **135**A.

In some examples, in response to the drone operations manager **125** receiving the reply message from the flight control platform **130** indicating approval of the flight plan, the session initiator **340** of the example interaction plane processor **320** also initiates an example observation communication session **415** between the selected drone observation platform **135**A and the payload unit **115**A of the selected drone **105**A. In the illustrated example of FIG. **4**, the observation communication session **415** is implemented by a data session (which may be a secure VPN session, an unsecure data session, etc.) in a wide area (e.g., mobile cellular and/or WiFi) network, such as the example network **155**, (or a combination of a wide area network and a

broadband/telecommunications network) capable of maintaining network communication between the drone **105**A and the drone observation platform **135**A as the drone is operated at the target location **150**. The observation communication session **415** of the illustrated example allows the selected drone observation platform **135**A of the SME to interface with the payload unit **115**A of the drone **105**A to, for example, access and/or control one or more capabilities of the drone, such as one or more sensors (e.g., cameras, microphones, gas detection sensors, temperature sensors, etc.), robotic arms, etc., other than the flight control aspects of the drone **105**A. For example, the observation communication session **415** permits the selected drone observation platform **135**A to receive sensor data and/or any other payload data from the drone **105**A. Additionally or alternatively, the observation communication session **415** may permit the drone observation platform **135**A to transmit control data to the drone to control operation of, for example, sensor(s) and/or other equipment (e.g., tools, object manipulators, etc.) carried by the drone **105**A (e.g., included in the payload unit **115**A of the drone **105**A).

In some examples, the interaction plane processor **320** of the example drone operations manager **125** of FIG. **3** includes an example drone data filter **345** to block (e.g., permanently, selectively, etc.) flight control data from being exchanged between the selected drone observation platform **135**A and the selected drone **105**A via the example observation communication session **415** to prevent the drone observation platform **135**A from being used to remotely pilot the drone **105**A. For example, the drone data filter **345** can block data packets having a source or destination address associated with a communication transceiver of the flight control unit **110**A of the selected drone **105**A. Additionally or alternatively, the drone data filter **345** can perform data packet inspection to block data packets formatted to transmit flight control commands to the selected drone **105**A, formatted to transmit flight control feedback data from the drone **105**A, etc.

In some such examples, the drone data filter **345** blocks flight control data from being exchanged between the selected drone observation platform **135**A and the selected drone **105**A via the example observation communication session **415** permanently, thereby preventing the drone observation platform **135**A from ever being used to remotely pilot the drone **105**A. However, in other examples, the drone data filter **345** implements selective blocking of the flight control data, which permits the drone observation platform **135**A to be used as a secondary piloting platform for flying the selected drone **105**A, with the selected flight control platform **130** being the primary piloting platform for flying the drone. For example, the drone data filter **345** may selectively block or unblock flight control data from being exchanged between the selected drone observation platform **135**A and the selected drone **105**A via the example observation communication session **415** based on an override command received from the flight control platform **130**. Such an implementation permits the SME to remotely pilot the selected drone **105**A at the target location **150** via the drone observation platform **135**A, but allows the drone pilot to retain overall responsibility for piloting the drone via the flight control platform **130** (e.g., by selectively overriding the ability of the drone observation platform **135**A to remotely pilot the drone **105**A for safety reasons, regulatory compliance, etc.).

In some examples, the session initiator **340** of the example interaction plane processor **320** utilizes the same conferencing communication session **410**, or other conferencing sessions, to allow personnel at the target location **150** to interact with the SME and/or the drone pilot. For example, the session initiator **340** may monitor the conferencing communication session **410** and add/delete the communication devices **160**A-B of the on-site personnel (and/or communication device(s) associated with other personnel) to/from the conferencing communication session **410** as appropriate. In this way, the communication devices **160**A-B can be used to exchange multimedia data (e.g., voice data, video data, text data) with the selected flight control platform **130** and/or the selected drone observation platform **135**A to permit other remote and/or on-scene personnel to interact with the SME and/or drone pilot, and/or to permit information obtained (e.g., sensed) by the drone **105**A to be conveyed to other remote and/or on-scene personnel, etc., as appropriate. Additionally or alternatively, in some examples, the session initiator **340** of the example interaction plane processor **320** initiates one or more observation communication sessions between the communication devices **160**A-B and the drone **105**A (e.g. separate from the observation communication session **415**) to allow the communication devices **160**A-B to interact with the payload unit **115**A of the drone **105**A, as described above. Such capabilities can improve the operational response and safety at the target location **150**, resulting in a safe or cost effective response, including potentially avoiding the need to dispatch responding personnel to the target location **150**.

Because the drones **105**A-C typically have limited operational power, the management plane processor **310** of the example drone operations manager **125** of FIG. **3** includes an example drone monitor **350** to monitor drone operation. For example, the drone monitor **350** may receive reports and/or warning messages from deployed drones, such as the deployed drone **105**A, which indicate that the drone is running low on power. In some examples, in response to a low power report/warning message received from the drone **105**A, and/or in response to a command received from the drone pilot via the flight control platform **130**, the drone monitor **350** cause the management plane processor **310** to deploy additional drone(s), such as the example drone **105**B, to achieve continuity of drone service at the target location **150**. For example, the management plane processor **310** can repeat the operations described above to select an appropriate backup drone(s), such as the drone **105**B, to relieve the primary drone **105**A on station, and can determine a flight plan for the selected drone.

To support handoff of the drone service from the primary drone **105**A to the backup drone **105**B, the piloting plane processor **315** of the example drone operations manager **125** of FIG. **3** includes an example session handoff manager **355**. For example, a second pilot may fly the backup drone **105**B via a second flight control platform to the target location **150**. The example session handoff manager **355** may then use any appropriate communications handoff procedure to swap control of the drones **105**A and **105**B such that the first pilot can continue to pilot the backup drone **105**B at the target location **150**, while the second pilot returns the former primary drone **105**A to its staging area.

In some examples, the management plane processor **310** of the example drone operations manager **125** of FIG. **3** supports anticipatory drone dispatching. For example, the drone monitor **350** may monitor the positions of deployed drones (e.g., in addition to monitoring the power status of deployed drones). If the drone monitor **350** determines that a deployed drone, such as the drone **105**A, being controlled by the pilot is anticipated to move beyond its operational range and/or deviate from its filed flight plan, the manage-

ment plane processor **310** can deploy another drone using the procedures described above to replace the first drone **105**A at an appropriate point along the drone's flight path. The example session handoff manager **355** can be used to swap control of the drones at the appropriate time. Anticipatory drone dispatching can be beneficial in many scenarios, such as scenarios in which the target location **150** is moving (e.g., such as when the drone **105**A is used to monitor a high-speed car chase, a wildfire, etc.).

An example implementation of the flight control platform **130** of FIG. **1** is illustrated in FIG. **5**. The example flight control platform **130** of FIG. **5** includes an example network interface **505** to communicate with one or more communication networks, links, etc., such as the example network **140** of FIG. **1**. The example network interface **505** can be implemented by any type(s), number(s) and/or combination (s) of interfaces, such as the example interface circuit **1220** of FIG. **12**, which is described in further detail below.

The example flight control platform **130** of FIG. **5** also include an example primary flight control interface **510** to implement a user interface via which a user may pilot a drone, such as one or more of the example drones **105**A-C. For example, the primary flight control interface **510** implements and/or interfaces with one or more physical controls (e.g., a joystick, a trackball, a keyboard, etc.) and/or virtual interface controls (e.g., one or more virtual touchscreen interface buttons, pads, sliders, switches) capable of generating flight control commands to be sent, via the network interface **505**, to the flight control unit (e.g., the example flight control unit **110**A) of the drone (e.g., the drone **105**A) being piloted. The primary flight control interface **510** also displays or otherwise presents flight control feedback data and/or other sensor data (e.g., such as instrumentation data, video data, etc.) received from the drone (e.g., from the drone flight control unit and/or the drone payload unit) via the network interface **505**. In the illustrated example of FIG. **5**, the primary flight control interface **510** further implements a communication endpoint of a piloting communication session, such as the piloting communication session **405**, to exchange the flight control commands and flight control feedback/sensor data with the drone being piloted (e.g., the drone **105**A), as described above and in further detail below. In some examples, the primary flight control interface **510** also interfaces with the payload unit (e.g., the payload unit **115**A) of the drone (e.g., the drone **105**A) to permit control of the sensors and/or other equipment carried by the drone, as described above and in further detail below.

The example flight control platform **130** of FIG. **5** further includes an example multimedia communications interface **515** to implement a communications endpoint for conferencing communication sessions (e.g., such as the example conferencing communication session **410**) established with other communication endpoints (e.g., such as the example drone observation platforms **135**A-C and/or the example communication devices **160**A-B). For example, the multimedia communications interface **515** may include a teleconferencing application to be executed to exchange multimedia data (e.g., voice data, video data, text data, graphical data, etc.) via the network interface **505** with other communication endpoints included in a conferencing communication session (e.g., such as the example conferencing communication session **410**). Additionally or alternatively, the multimedia communications interface **515** may include data processing and/or other applications to be executed to generate processed data (e.g., graphical data, tabular data, etc.) from sensor data received from a deployed drone. The multimedia communications interface **515** may then share this processed data with the other communication endpoints (e.g., such as the example drone observation platforms **135**A-C and/or the example communication devices **160**A-B) included in the conferencing communication session (e.g., such as the example conferencing communication session **410**), as described above and in further detail below.

An example drone observation platform **135** that may be used to implement one or more of the example drone observation platforms **135**A-C of FIG. **1** is illustrated in FIG. **6**. The example drone observation platform **135** of FIG. **6** includes an example network interface **605** to communicate with one or more communication networks, links, etc., such as the example network **140** of FIG. **1**. The example network interface **605** can be implemented by any type(s), number(s) and/or combination(s) of interfaces, such as the example interface circuit **1320** of FIG. **13**, which is described in further detail below.

The example drone observation platform **135** of FIG. **6** also includes an example multimedia communications interface **610** to implement a communications endpoint for conferencing communication sessions (e.g., such as the example conferencing communication session **410**) established with other communication endpoints (e.g., such as the example flight control platforms **130** and/or the example communication devices **160**A-B). For example, the multimedia communications interface **610** may include a teleconferencing application to be executed to exchange multimedia data (e.g., voice data, video data, text data, graphical data, etc.) via the network interface **605** with other communication endpoints included in a conferencing communication session (e.g., such as the example conferencing communication session **410**). Additionally or alternatively, the multimedia communications interface **610** may include data processing and/or other applications to be executed to generate processed data (e.g., graphical data, tabular data, etc.) from sensor data received from a deployed drone. The multimedia communications interface **610** may then share this processed data with the other communication endpoints (e.g., such as the example flight control platforms **130** and/or the example communication devices **160**A-B) included in the conferencing communication session (e.g., such as the example conferencing communication session **410**), as described above and in further detail below.

The example drone observation platform **135** of FIG. **6** further includes an example payload control interface **615** to implement a communications endpoint for observation communication sessions (e.g., such as the example observation communication session **415**) established with one or more deployed drones (e.g., such as the example drone **105**A). The payload control interface **615** implements and/or interfaces with one or more physical controls (e.g., a joystick, a trackball, a keyboard, etc.) and/or virtual interface controls (e.g., one or more virtual touchscreen interface buttons, pads, sliders, switches) capable of generating payload control commands to be sent, via the network interface **605**, to control sensors, equipment, etc., included in the payload unit (e.g., the example payload unit **115**A) of a deployed drone (e.g., the drone **105**A). The payload control interface **615** also displays or otherwise presents sensor data (e.g., such as instrumentation data, video data, etc.) received from the drone (e.g. the drone payload unit) via the network interface **605**.

The example drone observation platform **135** of FIG. **6** also includes an example secondary flight control interface **620** to exchange flight control commands and flight control feedback/sensor data with the drone being piloted (e.g., the drone **105**A), as described above and in further detail below.

In some examples, the ability to control a deployed drone (e.g., the drone **105**A) via the secondary flight control interface **620** may be overridden by one or more commands issued by a flight control platform (e.g., such as the example flight control platform **130**) also operating the deployed drone (e.g., the drone **105**A).

Although the example drone deployment system **100** of FIG. **1** is depicted as including three example drones **105**A-C, one example drone operations manager **125**, one example flight control platform **130** and three example drone observation platforms **135**A-C, the example drone deployment system **100** is not limited thereto. For example, the drone deployment system **100** can include any number of drones **105**A-C, drone operations managers **125**, flight control platforms **130** and/or drone observation platforms **135**A-C implemented to support computer aided dispatch of drones in accordance with the teachings of this disclosure. Also, although the example drone deployment system **100** of FIG. **1** is depicted as receiving service requests from one example CAD system **145**, the example drone deployment system **100** is not limited thereto. For example, the drone deployment system **100** can include one or more drone operations managers **125** structured to receive service requests from any number of CAD systems **145**, and/or from any other source(s) of service requests. For example, service requests can originate from any computing device capable of specifying a target location (e.g., using global positioning system (GPS) coordinates, latitude and longitude coordinates, preconfigured waypoints, etc.) to which a drone is to be deployed.

Furthermore, computer aided dispatch of drones as implemented by the example drone deployment system **100** disclosed herein can be applied to many disciplines including, but not limited to, emergency response scenarios. For example, consider the issues faced by public utility companies, such as telecommunications and electric utility companies. After a storm, the example drone deployment system **100** can be used to dispatch one or more drones **105**A-C to one or more facilities associated with one or more utility outage areas (e.g., including an outage area associated with the target location **150**). An SME can use information obtained via a deployed drone to evaluate whether there is a problem with a particular facility (e.g., power station, cell tower, etc.) and which resources, (e.g., a bucket truck, or just a service van) should be dispatched. Remote inspection of the facility using a drone can save the utility company a substantial amount of money, but should be done quickly to achieve desired outage response times. The example drone deployment system **100** enables such quick response times.

While example manners of implementing the example drone deployment system **100** are illustrated in FIGS. **1-6**, one or more of the elements, processes and/or devices illustrated in FIGS. **1-6** may be combined, divided, rearranged, omitted, eliminated and/or implemented in any other way. Further, the example drones **105**A, the example flight control unit **110**A, the example payload unit **115**A, the example docking stations **120**B-C, the example drone operations manager **125**, the example flight control platform **130**, the example drone observation platforms **135** and/or **135**A-C, the example networks **140** and/or **155**, the example communication devices **160**A-B, the example drone management plane **205**, the example piloting plane **210**, the example drone interaction plane **215**, example network interface **305**, the example management plane processor **310**, the example piloting plane processor **315**, the example interaction plane processor **320**, the example CAD request processor **325**, the example flight plan processor **330**, the example session initiator **335**, the example session initiator **340**, the example drone data filter **345**, the example drone monitor **350**, the example session handoff manager **355**, the example network interface **505**, the example primary flight control interface **510**, the example multimedia communications interface **515**, the example network interface **605**, the example multimedia communications interface **610**, the example payload control interface **615**, the example secondary flight control interface **620** and/or, more generally, the example drone deployment system **100** of FIGS. **1-6** may be implemented by hardware, software, firmware and/or any combination of hardware, software and/or firmware. Thus, for example, any of the example drones **105**A, the example flight control unit **110**A, the example payload unit **115**A, the example docking stations **120**B-C, the example drone operations manager **125**, the example flight control platform **130**, the example drone observation platforms **135** and/or **135**A-C, the example networks **140** and/or **155**, the example communication devices **160**A-B, the example drone management plane **205**, the example piloting plane **210**, the example drone interaction plane **215**, example network interface **305**, the example management plane processor **310**, the example piloting plane processor **315**, the example interaction plane processor **320**, the example CAD request processor **325**, the example flight plan processor **330**, the example session initiator **335**, the example session initiator **340**, the example drone data filter **345**, the example drone monitor **350**, the example session handoff manager **355**, the example network interface **505**, the example primary flight control interface **510**, the example multimedia communications interface **515**, the example network interface **605**, the example multimedia communications interface **610**, the example payload control interface **615**, the example secondary flight control interface **620** and/or, more generally, the example drone deployment system **100** could be implemented by one or more analog or digital circuit(s), logic circuits, programmable processor(s), application specific integrated circuit(s) (ASIC(s)), programmable logic device (s) (PLD(s)) and/or field programmable logic device(s) (FPLD(s)). When reading any of the apparatus or system claims of this patent to cover a purely software and/or firmware implementation, at least one of the example drone deployment system **100**, the example drones **105**A, the example flight control unit **110**A, the example payload unit **115**A, the example docking stations **120**B-C, the example drone operations manager **125**, the example flight control platform **130**, the example drone observation platforms **135** and/or **135**A-C, the example networks **140** and/or **155**, the example communication devices **160**A-B, the example drone management plane **205**, the example piloting plane **210**, the example drone interaction plane **215**, example network interface **305**, the example management plane processor **310**, the example piloting plane processor **315**, the example interaction plane processor **320**, the example CAD request processor **325**, the example flight plan processor **330**, the example session initiator **335**, the example session initiator **340**, the example drone data filter **345**, the example drone monitor **350**, the example session handoff manager **355**, the example network interface **505**, the example primary flight control interface **510**, the example multimedia communications interface **515**, the example network interface **605**, the example multimedia communications interface **610**, the example payload control interface **615** and/or the example secondary flight control interface **620** is/are hereby expressly defined to include a tangible computer readable storage device or storage disk such as a memory, a digital versatile disk (DVD), a compact disk (CD), a Blu-ray disk,

etc. storing the software and/or firmware. Further still, the example drone deployment system **100** may include one or more elements, processes and/or devices in addition to, or instead of, those illustrated in FIGS. **1-6**, and/or may include more than one of any or all of the illustrated elements, processes and devices.

Flowcharts representative of example machine readable instructions for implementing the example drone deployment system **100**, the example drones **105**A, the example flight control unit **110**A, the example payload unit **115**A, the example docking stations **120**B-C, the example drone operations manager **125**, the example flight control platform **130**, the example drone observation platforms **135** and/or **135**A-C, the example networks **140** and/or **155**, the example communication devices **160**A-B, the example drone management plane **205**, the example piloting plane **210**, the example drone interaction plane **215**, example network interface **305**, the example management plane processor **310**, the example piloting plane processor **315**, the example interaction plane processor **320**, the example CAD request processor **325**, the example flight plan processor **330**, the example session initiator **335**, the example session initiator **340**, the example drone data filter **345**, the example drone monitor **350**, the example session handoff manager **355**, the example network interface **505**, the example primary flight control interface **510**, the example multimedia communications interface **515**, the example network interface **605**, the example multimedia communications interface **610**, the example payload control interface **615** and/or the example secondary flight control interface **620** are shown in FIGS. **7**A-B and **8-10**. In these examples, the machine readable instructions comprise one or more programs for execution by a processor, such as the processors **1112**, **1212** and/or **1312** shown in the example processor platforms **1100**, **1200** and/or **1300** discussed below in connection with FIGS. **11-13**. The one or more programs, or portion(s) thereof, may be embodied in software stored on a tangible computer readable storage medium such as a CD-ROM, a floppy disk, a hard drive, a digital versatile disk (DVD), a Blu-ray Disk™, or a memory associated with the processors **1112**, **1212** and/or **1312**, but the entire program or programs and/or portions thereof could alternatively be executed by a device other than the processors **1112**, **1212** and/or **1312**, and/or embodied in firmware or dedicated hardware (e.g., implemented by an ASIC, a PLD, an FPLD, discrete logic, etc.). Further, although the example program(s) is(are) described with reference to the flowcharts illustrated in FIGS. **7**A-B and **8-10**, many other methods of implementing the example drone deployment system **100**, the example drones **105**A, the example flight control unit **110**A, the example payload unit **115**A, the example docking stations **120**B-C, the example drone operations manager **125**, the example flight control platform **130**, the example drone observation platforms **135** and/or **135**A-C, the example networks **140** and/or **155**, the example communication devices **160**A-B, the example drone management plane **205**, the example piloting plane **210**, the example drone interaction plane **215**, example network interface **305**, the example management plane processor **310**, the example piloting plane processor **315**, the example interaction plane processor **320**, the example CAD request processor **325**, the example flight plan processor **330**, the example session initiator **335**, the example session initiator **340**, the example drone data filter **345**, the example drone monitor **350**, the example session handoff manager **355**, the example network interface **505**, the example primary flight control interface **510**, the example multimedia communications interface **515**, the example network interface **605**, the example multimedia communications interface **610**, the example payload control interface **615** and/or the example secondary flight control interface **620** may alternatively be used. For example, with reference to the flowcharts illustrated in FIGS. **7**A-B and **8-10**, the order of execution of the blocks may be changed, and/or some of the blocks described may be changed, eliminated, combined and/or subdivided into multiple blocks.

As mentioned above, the example processes of FIGS. **7**A-B and **8-10** may be implemented using coded instructions (e.g., computer and/or machine readable instructions) stored on a tangible computer readable storage medium such as a hard disk drive, a flash memory, a read-only memory (ROM), a compact disk (CD), a digital versatile disk (DVD), a cache, a random-access memory (RAM) and/or any other storage device or storage disk in which information is stored for any duration (e.g., for extended time periods, permanently, for brief instances, for temporarily buffering, and/or for caching of the information). As used herein, the term tangible computer readable storage medium is expressly defined to include any type of computer readable storage device and/or storage disk and to exclude propagating signals and to exclude transmission media. As used herein, "tangible computer readable storage medium" and "tangible machine readable storage medium" are used interchangeably. Additionally or alternatively, the example processes of FIGS. **7**A-B and **8-10** may be implemented using coded instructions (e.g., computer and/or machine readable instructions) stored on a non-transitory computer and/or machine readable medium such as a hard disk drive, a flash memory, a ROM, a CD, a DVD, a cache, a RAM and/or any other storage device or storage disk in which information is stored for any duration (e.g., for extended time periods, permanently, for brief instances, for temporarily buffering, and/or for caching of the information). As used herein, the term non-transitory computer readable medium is expressly defined to include any type of computer readable storage device and/or storage disk and to exclude propagating signals and to exclude transmission media. As used herein, when the phrase "at least" is used as the transition term in a preamble of a claim, it is open-ended in the same manner as the terms "comprising" and "including" are open ended. Also, as used herein, the terms "computer readable" and "machine readable" are considered equivalent unless indicated otherwise.

An example program **700** that may be executed to implement the example drone operations manager **125** of FIGS. **1**, **3** and/or **4** is represented by the flowchart illustrated in FIGS. **7**A-B. For convenience and without loss of generality, execution of the example program **700** is described from the perspective of the example drone operations manager **125** of FIG. **3** being included in the example drone deployment system **100** of FIGS. **1** and **4**. With reference to the preceding figures and associated written descriptions, the example program **700** begins execution at block **705** of FIG. **7**A at which the example CAD request processor **325** of the example management plane processor **310** included in the drone operations manager **125** accesses a service request received from the example CAD system **145**. At block **710**, the CAD request processor **325** processes a target location and/or other descriptive information included in the service request to select a drone, to select a flight control platform associated with a pilot and to select a drone observation platform associated with a SME to support the service request. The remainder of the description of FIGS. **7**A-B assumes that, at block **710**, the CAD request processor **325** selects the drone **105**A, the flight control platform **130** and

the drone observation platform **135** to support the service request, and the service request is for the target location **150**.

At block **715**, the example flight plan processor **330** of the example management plane processor **310** included in the drone operations manager **125** determines a flight plan for flying the selected drone **105**A to the target location **150**. At block **720**, the flight plan processor **330** transmits the determined flight plan to the selected flight control platform **130** to request approval of the flight plan. If the flight plan processor **330** receives a reply message from the flight control platform **130** indicating that the flight plan has been approved (block **725**), processing proceeds to block **730**. Otherwise, execution of the program **700** proceeds to block **760** of FIG. **7**B.

At block **760** of FIG. **7**B, the flight plan processor **330** evaluates flight plan alternatives in an attempt to obtain approval of an alternate flight plan by varying one or more parameters/preferences used to determine the flight plan. For example, at block **760**, the flight plan processor **330** may determine whether one or more parameters/preferences used by the automating mapping application(s) to determine the flight plan can be varied. Additionally or alternatively, at block **760**, the flight plan processor **330** may evaluate whether one or more other drones **105**B-C, possibly located at other staging location(s), are available and may yield an alternative flight plan. If the flight plan processor **330** determines that such alternative parameters/preferences for generating a flight plan are available (block **765**), processing proceeds to block **770** at which the flight plan processor **330** determines an alternative flight plan for flying the selected drone (e.g., which may be the same as, or different from, the drone **105**A selected at block **710**) to the target location **150**. If determination of an alternative flight plan is successful (block **770**), processing returns to block **720** of FIG. **7**A at which the flight plan processor **330** transmits the alternative flight plan to the selected flight control platform **130** to request approval of the alternative flight plan. However, if determination of an alternative flight plan is unsuccessful (block **770**), execution of the example program **700** ends. In some examples, the flight plan processor **330** continues to iterate through the processing of blocks **760**-**775** until either an alternative flight plan is approved or the possible alternative flight plans have been exhausted.

In some examples, obtaining approval of the flight plan at block **725** also involves the flight plan processor **330** transmitting the flight plan (e.g., after receiving approval from the drone pilot via the flight control platform **130**) to the appropriate regulating agency (e.g., the FAA) and receiving approval of the flight plan from that agency. In some such examples, if the flight plan processor **330** receives a response message from the appropriate agency indicating the flight plan is approved, processing proceeds from block **725** to block **730**. Otherwise, processing proceeds to block **760** at which the flight plan processor **330** attempts to determine an alternative flight plan. In some such examples, the regulating agency (e.g., the FAA) may indicate that the flight plan is transiently not approvable (e.g., because the flight plan crosses the path of another aerial device), but may be approvable at a later time. Additionally or alternatively, the regulating agency (e.g., the FAA) may return one or more processing codes to indicate to the flight plan processor **330** how to resolve one or more problems with the submitted flight plan (e.g., such as a code indicating the selected pilot of the selected drone **105**A has an expired license, etc.). In some such examples, at blocks **760** and/or **770**, the flight plan processor **330** implements logic to process such code(s) and/or transient disapproval indication(s) to resolve the identified problem(s) with the submitted flight plan.

In some examples, at blocks **715** and/or **770**, the flight plan processor **330** determines flight plans to avoid restricted airspace (e.g., around airports, secure facilities, etc.) by default. In some such examples, the appropriate regulating agency (e.g., the FAA) can provide a key, a code, etc., or other authorization mechanism to the flight plan processor **330** to permit the flight plan processor **330** to override (e.g., ignore) these default restrictions (e.g., based on need). In some examples, the appropriate regulating agency (e.g., the FAA) can also provide a key, a code, etc., or other authorization mechanism to the flight plan processor **330** to configure the selected drone (e.g., the drone **105**A) to broadcast a restriction override or other authorization signal to, for example, disable any active deterrents that may attempt to interfere with the drone while it operates in the restricted airspace.

Assuming the flight plan for flying the selected drone **105**A to the target location **150** is approved, processing proceeds to block **730** of FIG. **7**A. At block **730**, the example session initiator **335** of the example piloting plane processor **315** included in the drone operations manager **125** initiates the example piloting communication session **405** between the selected flight control platform **130** and the selected drone **105**A to allow the flight control platform **130** to transmit flight control commands and receive flight control feedback and/or other sensor data to remotely pilot the drone **105**A. At block **735**, the example session initiator **340** of the example interaction plane processor **320** included in the drone operations manager **125** initiates the example conferencing communication session **410** between the selected drone observation platform **135**A and the selected flight control platform **130** to permit multimedia data, such as voice data, video data, text data, graphical data etc., to be exchanged between the drone observation platform **135**A and the selected flight control platform **130** to enable the selected SME to interact with the selected drone pilot in real-time. At block **740**, the example session initiator **340** of the example interaction plane processor **320** initiates the example observation communication session **415** between the selected drone observation platform **135**A and the selected drone **105**A to allow the drone observation platform **135**A to interact with the payload unit **115**A of the drone **105**A to, for example, access and/or control one or more capabilities of the drone. In some examples, the observation communication session **415** also allows the drone observation platform **135**A to remotely pilot the selected drone **105**A (e.g., in a manner that is subordinate to the flight control platform **130**).

At block **745**, the drone operations manager **125** performs session monitoring and management while the selected drone **105**A is deployed. Example machine readable instructions that may be executed to perform the processing at block **745** are illustrated in FIG. **8**, which is described in further detail below. At block **750**, the drone operations manager **125** determines whether the support of the service request has completed. For example, the drone operations manager **125** may determine that support of the service request has completed when the selected drone **105**A has returned to its staging area and no backup/secondary drone is operating as its replacement. If support of the service request has not completed (block **750**), processing returns to block **745**. However, if support of the service request has completed (block **750**), then the drone operations manager **125** tears down (or, in other words, terminates) (block **755**)

the communication session initiated to support the service request. Execution of the example program **700** then ends.

An example program P**745** that may be executed to perform the processing at block **745** of FIG. **7**A is represented by the flowchart illustrated in FIG. **8**. For convenience and without loss of generality, execution of the example program P**745** is described from the perspective of the example drone operations manager **125** of FIG. **3** being included in the example drone deployment system **100** of FIGS. **1** and **4**. With reference to the preceding figures and associated written descriptions, the example program P**745** begins execution at block **805** at which the example session initiator **340** of the example interaction plane processor **320** included in the drone operations manager **125** determines whether the example conferencing communication session **410**, which was originally initiated between the selected drone observation platform **135**A and the selected flight control platform **130**, is to be updated. If the conferencing communication session **410** is to be updated (block **805**), then at block **810** the session initiator **340** of the example interaction plane processor **320** adds and/or removes communication device(s), such as the communication device(s) **160**A-B, to/from the conferencing communication session **410**, as appropriate.

At block **815**, the example drone data filter **345** of the example interaction plane processor **320** included in the drone operations manager **125** determine whether a flight control override command has been received from the selected flight control platform **130**. If a flight control override command has been received (block **815**), then at block **820** the drone data filter **345** blocks flight control data (and possibly flight control feedback/sensor data) from being exchanged between the selected drone observation platform **135**A and the selected drone **105**A via the example observation communication session **415** to prevent the drone observation platform **135**A from being used to remotely pilot the drone **105**A.

At block **825**, the example drone monitor **350** of the example management plane processor **310** included in the drone operations manager **125** determines whether the deployed drone **105**A is projected to deviate from its flight plan. If flight plan deviation is projected (block **825**), then at block **830** the management plane processor **310** included in the drone operations manager **125** performs anticipatory drone dispatching, as described above.

At block **835**, the example drone monitor **350** of the example management plane processor **310** determines whether the selected drone **105**A has reported a low power warning. If the selected drone **105**A has reported a low power warning (block **835**), then at block **840** the example session handoff manager **355** of the example piloting plane processor **315** included in the drone operations manager **125** performs a drone handoff procedure, as described above, to handoff drone operations at the target location **150** to a backup drone, such as the drone **105**B.

An example program **900** that may be executed to implement the example flight control platform **130** of FIGS. **1**, **4** and/or **5** is represented by the flowchart illustrated in FIG. **9**. For convenience and without loss of generality, execution of the example program **900** is described from the perspective of the example flight control platform **130** of FIG. **5** being included in the example drone deployment system **100** of FIGS. **1** and **4**. With reference to the preceding figures and associated written descriptions, the example program **900** of FIG. **9** begins execution at block **905** at which the example primary flight control interface **510** of the flight control platform **130** receives a flight plan from the example drone operations manager **125**. At block **910**, the flight control interface **510** generates one or more user interface prompts for a pilot operating the flight control platform **130** to approve or disapprove the received flight plan. If a user input received in response to the user interface prompt(s) indicates that the flight plan has not been approved (block **915**), then at block **920** the flight control interface **510** returns a reply message to the drone operations manager **125** indicating that the flight plan has not been approved. Execution of the example program **900** then ends.

However, if a user input received in response to the user interface prompt(s) indicates that the flight plan has been approved (block **915**), then at block **925** the flight control interface **510** returns a reply message to the drone operations manager **125** indicating that the flight plan has been approved. Sometime later, at block **930**, the flight control interface **510** receives a request to join the example piloting communication session **405** being initiated between the selected drone **105**A and the flight control platform **130**. At block **935**, the flight control interface **510** accepts the request (e.g., automatically or responsive to a user input) and joins the piloting communication session **405** to enable flight control commands and flight control feedback/sensor data to be exchanged with the drone **105**A to permit remote piloting of the drone, as described above.

At block **940**, the example multimedia communications interface **515** of the flight control platform **130** receives a request to join the example conferencing communication session **410** being initiated between the selected drone observation platform **135**A and the flight control platform **130**. At block **945**, the multimedia communications interface **515** accepts the request (e.g., automatically or responsive to a user input) and joins the conferencing communication session **410** to enable multimedia data to be exchanged between the selected drone observation platform **135**A and the flight control platform **130** to permit real-time interaction between the SME and the drone pilot, as described above.

At block **950**, the primary flight control interface **510** uses the piloting communication session **405** to exchange flight control commands and flight control feedback/sensor data with the deployed drone **105**A to enable remote piloting of the drone. At block **955**, the flight control interface **510** detects whether a command to override secondary piloting of the drone **105**A has been input by the pilot. If the secondary piloting override command is detected (block **955**), then at block **960** the flight control interface **510** transmits a secondary piloting override command to the drone operations manager **125**, which causes the drone operations manager **125** to block the drone observation platform **135**A (and/or any other device) from being able to remotely pilot the drone **105**A.

At block **965**, the flight control platform **130** determines whether remote piloting of the deployed drone **105**A has completed (e.g., such as when the drone **105**A has been returned to its staging area). If drone piloting is not completed (block **965**), then processing returns to block **950** to permit the flight control platform **130** to continue to be used to remotely pilot the drone **105**A. However, if drone piloting has completed (block **965**), execution of the example program **900** then ends after the flight control platform **130** disconnects from communication sessions (block **970**).

An example program **1000** that may be executed to implement the example drone observation platforms **135** and/or **135**A-C of FIGS. **1**, **4** and/or **6** is represented by the flowchart illustrated in FIG. **10**. For convenience and without loss of generality, execution of the example program **1000** is described from the perspective of the example drone

observation platform **135** of FIG. **6** being used to implement the example drone observation platform **135**A in the example drone deployment system **100** of FIGS. **1** and **4**. With reference to the preceding figures and associated written descriptions, the example program **1000** of FIG. **10** begins execution at block **1005** at which the example multimedia communications interface **610** of the drone observation platform **135** receives a request to join the example conferencing communication session **410** being initiated between the selected flight control platform **130** and the drone observation platform **135**. At block **1010**, the multimedia communications interface **610** accepts the request (e.g., automatically or responsive to a user input) and joins the conferencing communication session **410** to enable multimedia data to be exchanged between the selected flight control platform **130** and the drone observation platform **135** to permit real-time interaction between the SME and the drone pilot, as described above.

At block **1015**, the example payload control interface **615** of the drone observation platform **135** receives a request to join the example observation communication session **415** being initiated between the selected drone **105**A and the drone observation platform **135**. At block **1020**, the payload control interface **615** accepts the request (e.g., automatically or responsive to a user input) and joins the observation communication session **415** to enable the drone observation platform **135** to interact with the sensor(s) and/or other equipment carried by the drone **105**A (e.g., included in its payload unit **115**A), as described above. For example, at block **1025**, the payload control interface **615** receives sensor data via the observation communication session **415** from one or more sensors included in the payload unit **115**A of the selected drone **105**A. At block **1030**, the payload control interface **615** transmits control data via the observation communication session **415** to control operation of one or more sensors and/or other equipment included in the payload unit **115**A of the selected drone **105**A.

At block **1035**, the example secondary flight control interface **620** of the drone observation platform **135** determines whether secondary piloting of the drone **105**A is permitted. For example, the drone operations manager **125** may send messages to the drone observation platform **135** to indicate whether secondary drone piloting is permitted based on whether a piloting override command has been received by the drone operations manager **125** from the flight control platform **130**. In some such examples, secondary drone piloting is permitted if no piloting override command has been received. If secondary drone piloting is permitted (block **1035**), then at block **1040** the secondary flight control interface **620** exchanges flight control commands and flight control feedback/sensor data with the drone **105**A (e.g., via the observation communication session **415** and/or another communication session established between the drone observation platform **135** and the drone **105**A) to pilot the drone **105**A remotely.

At block **1045**, the drone observation platform **135** determines whether deployment of the drone **105**A has completed (e.g., such as when the drone **105**A has been returned to its staging area). If drone deployment is not completed (block **1045**), then processing returns to block **1025** to permit the drone observation platform **135** to exchanging data with the deployed drone **105**A. However, if drone deployment has completed (block **1045**), execution of the example program **1000** then ends after the drone observation platform **135** disconnects from communication sessions (block **1050**).

FIG. **11** is a block diagram of an example processor platform **1100** capable of executing the instructions of FIGS. **7**A-B and/or **8** to implement the example drone operations manager **125** of FIGS. **1**, **3** and/or **4**. The processor platform **1100** can be, for example, a server, a personal computer, a mobile device (e.g., a cell phone, a smart phone, a tablet such as an iPad™), a personal digital assistant (PDA), an Internet appliance, or any other type of computing device.

The processor platform **1100** of the illustrated example includes a processor **1112**. The processor **1112** of the illustrated example is hardware. For example, the processor **1112** can be implemented by one or more integrated circuits, logic circuits, microprocessors or controllers from any desired family or manufacturer. In the illustrated example of FIG. **11**, the processor **1112** includes one or more example processing cores **1115** configured via example instructions **1132**, which include the example instructions of FIGS. **7**A-B and/or **8**, to implement the example management plane processor **310**, the example piloting plane processor **315**, the example interaction plane processor **320**, the example CAD request processor **325**, the example flight plan processor **330**, the example session initiator **335**, the example session initiator **340**, the example drone data filter **345**, the example drone monitor **350** and/or the example session handoff manager **355** of FIG. **3**.

The processor **1112** of the illustrated example includes a local memory **1113** (e.g., a cache). The processor **1112** of the illustrated example is in communication with a main memory including a volatile memory **1114** and a non-volatile memory **1116** via a link **1118**. The link **1118** may be implemented by a bus, one or more point-to-point connections, etc., or a combination thereof. The volatile memory **1114** may be implemented by Synchronous Dynamic Random Access Memory (SDRAM), Dynamic Random Access Memory (DRAM), RAMBUS Dynamic Random Access Memory (RDRAM) and/or any other type of random access memory device. The non-volatile memory **1116** may be implemented by flash memory and/or any other desired type of memory device. Access to the main memory **1114**, **1116** is controlled by a memory controller.

The processor platform **1100** of the illustrated example also includes an interface circuit **1120**. The interface circuit **1120** may be implemented by any type of interface standard, such as an Ethernet interface, a universal serial bus (USB), and/or a PCI express interface.

In the illustrated example, one or more input devices **1122** are connected to the interface circuit **1120**. The input device(s) **1122** permit(s) a user to enter data and commands into the processor **1112**. The input device(s) can be implemented by, for example, an audio sensor, a microphone, a camera (still or video), a keyboard, a button, a mouse, a touchscreen, a track-pad, a trackball, a trackbar (such as an isopoint), a voice recognition system and/or any other human-machine interface. Also, many systems, such as the processor platform **1100**, can allow the user to control the computer system and provide data to the computer using physical gestures, such as, but not limited to, hand or body movements, facial expressions, and face recognition.

One or more output devices **1124** are also connected to the interface circuit **1120** of the illustrated example. The output devices **1124** can be implemented, for example, by display devices (e.g., a light emitting diode (LED), an organic light emitting diode (OLED), a liquid crystal display, a cathode ray tube display (CRT), a touchscreen, a tactile output device, a printer and/or speakers). The interface circuit **1120** of the illustrated example, thus, typically includes a graphics driver card, a graphics driver chip or a graphics driver processor.

The interface circuit **1120** of the illustrated example also includes a communication device such as a transmitter, a receiver, a transceiver, a modem and/or network interface card to facilitate exchange of data with external machines (e.g., computing devices of any kind) via a network **1126** (e.g., an Ethernet connection, a digital subscriber line (DSL), a telephone line, coaxial cable, a cellular telephone system, etc.). In the illustrated example of FIG. **11**, the interface circuit **1120** is also structured to implement the example network interface **305** of FIG. **3**.

The processor platform **1100** of the illustrated example also includes one or more mass storage devices **1128** for storing software and/or data. Examples of such mass storage devices **1128** include floppy disk drives, hard drive disks, compact disk drives, Blu-ray disk drives, RAID (redundant array of independent disks) systems, and digital versatile disk (DVD) drives.

Coded instructions **1132** corresponding to the instructions of FIGS. **7**A-B and/or **8** may be stored in the mass storage device **1128**, in the volatile memory **1114**, in the non-volatile memory **1116**, in the local memory **1113** and/or on a removable tangible computer readable storage medium, such as a CD or DVD **1136**.

FIG. **12** is a block diagram of an example processor platform **1200** capable of executing the instructions of FIG. **9** to implement the example flight control platform **130** of FIGS. **1**, **4** and/or **5**. The processor platform **1200** can be, for example, a server, a personal computer, a mobile device (e.g., a cell phone, a smart phone, a tablet such as an iPad™), a PDA, an Internet appliance, or any other type of computing device.

The processor platform **1200** of the illustrated example includes a processor **1212**. The processor **1212** of the illustrated example is hardware. For example, the processor **1212** can be implemented by one or more integrated circuits, logic circuits, microprocessors or controllers from any desired family or manufacturer. In the illustrated example of FIG. **12**, the processor **1212** includes one or more example processing cores **1215** configured via example instructions **1232**, which include the example instructions of FIG. **9**, to implement the example primary flight control interface **510** and/or the example multimedia communications interface **515** of FIG. **5**.

The processor **1212** of the illustrated example includes a local memory **1213** (e.g., a cache). The processor **1212** of the illustrated example is in communication with a main memory including a volatile memory **1214** and a non-volatile memory **1216** via a link **1218**. The link **1218** may be implemented by a bus, one or more point-to-point connections, etc., or a combination thereof. The volatile memory **1214** may be implemented by SDRAM, DRAM, RDRAM and/or any other type of random access memory device. The non-volatile memory **1216** may be implemented by flash memory and/or any other desired type of memory device. Access to the main memory **1214**, **1216** is controlled by a memory controller.

The processor platform **1200** of the illustrated example also includes an interface circuit **1220**. The interface circuit **1220** may be implemented by any type of interface standard, such as an Ethernet interface, a USB, and/or a PCI express interface.

In the illustrated example, one or more input devices **1222** are connected to the interface circuit **1220**. The input device(s) **1222** permit(s) a user to enter data and commands into the processor **1212**. The input device(s) can be implemented by, for example, an audio sensor, a microphone, a camera (still or video), a keyboard, a button, a mouse, a touchscreen, a track-pad, a trackball, a trackbar (such as an isopoint), a voice recognition system and/or any other human-machine interface. Also, many systems, such as the processor platform **1200**, can allow the user to control the computer system and provide data to the computer using physical gestures, such as, but not limited to, hand or body movements, facial expressions, and face recognition.

One or more output devices **1224** are also connected to the interface circuit **1220** of the illustrated example. The output devices **1224** can be implemented, for example, by display devices (e.g., an LED display, an OLED display, a liquid crystal display, a CRT display, a touchscreen, a tactile output device, a printer and/or speakers). The interface circuit **1220** of the illustrated example, thus, typically includes a graphics driver card, a graphics driver chip or a graphics driver processor.

The interface circuit **1220** of the illustrated example also includes a communication device such as a transmitter, a receiver, a transceiver, a modem and/or network interface card to facilitate exchange of data with external machines (e.g., computing devices of any kind) via a network **1226** (e.g., an Ethernet connection, a DSL, a telephone line, coaxial cable, a cellular telephone system, etc.). In the illustrated example of FIG. **12**, the interface circuit **1220** is also structured to implement the example network interface **505** of FIG. **5**.

The processor platform **1200** of the illustrated example also includes one or more mass storage devices **1228** for storing software and/or data. Examples of such mass storage devices **1228** include floppy disk drives, hard drive disks, compact disk drives, Blu-ray disk drives, RAID systems, and DVD drives.

Coded instructions **1232** corresponding to the instructions of FIG. **9** may be stored in the mass storage device **1228**, in the volatile memory **1214**, in the non-volatile memory **1216**, in the local memory **1213** and/or on a removable tangible computer readable storage medium, such as a CD or DVD **1236**.

FIG. **13** is a block diagram of an example processor platform **1300** capable of executing the instructions of FIG. **10** to implement the example drone observation platforms **135** and/or **135**A-C of FIGS. **1**, **4** and/or **6**. The processor platform **1300** can be, for example, a server, a personal computer, a mobile device (e.g., a cell phone, a smart phone, a tablet such as an iPad™), a PDA, an Internet appliance, or any other type of computing device.

The processor platform **1300** of the illustrated example includes a processor **1312**. The processor **1312** of the illustrated example is hardware. For example, the processor **1312** can be implemented by one or more integrated circuits, logic circuits, microprocessors or controllers from any desired family or manufacturer. In the illustrated example of FIG. **13**, the processor **1312** includes one or more example processing cores **1315** configured via example instructions **1332**, which include the example instructions of FIG. **10**, to implement the example multimedia communications interface **610**, the example payload control interface **615** and/or the example secondary flight control interface **620** of FIG. **6**.

The processor **1312** of the illustrated example includes a local memory **1313** (e.g., a cache). The processor **1312** of the illustrated example is in communication with a main memory including a volatile memory **1314** and a non-volatile memory **1316** via a link **1318**. The link **1318** may be implemented by a bus, one or more point-to-point connections, etc., or a combination thereof. The volatile memory **1314** may be implemented by SDRAM, DRAM, RDRAM and/or any other type of random access memory device. The

non-volatile memory **1316** may be implemented by flash memory and/or any other desired type of memory device. Access to the main memory **1314**, **1316** is controlled by a memory controller.

The processor platform **1300** of the illustrated example also includes an interface circuit **1320**. The interface circuit **1320** may be implemented by any type of interface standard, such as an Ethernet interface, a USB, and/or a PCI express interface.

In the illustrated example, one or more input devices **1322** are connected to the interface circuit **1320**. The input device(s) **1322** permit(s) a user to enter data and commands into the processor **1312**. The input device(s) can be implemented by, for example, an audio sensor, a microphone, a camera (still or video), a keyboard, a button, a mouse, a touchscreen, a track-pad, a trackball, a trackbar (such as an isopoint), a voice recognition system and/or any other human-machine interface. Also, many systems, such as the processor platform **1300**, can allow the user to control the computer system and provide data to the computer using physical gestures, such as, but not limited to, hand or body movements, facial expressions, and face recognition.

One or more output devices **1324** are also connected to the interface circuit **1320** of the illustrated example. The output devices **1324** can be implemented, for example, by display devices (e.g., an LED display, an OLED display, a liquid crystal display, a CRT display, a touchscreen, a tactile output device, a printer and/or speakers). The interface circuit **1320** of the illustrated example, thus, typically includes a graphics driver card, a graphics driver chip or a graphics driver processor.

The interface circuit **1320** of the illustrated example also includes a communication device such as a transmitter, a receiver, a transceiver, a modem and/or network interface card to facilitate exchange of data with external machines (e.g., computing devices of any kind) via a network **1326** (e.g., an Ethernet connection, a DSL, a telephone line, coaxial cable, a cellular telephone system, etc.). In the illustrated example of FIG. **13**, the interface circuit **1320** is also structured to implement the example network interface **605** of FIG. **6**.

The processor platform **1300** of the illustrated example also includes one or more mass storage devices **1328** for storing software and/or data. Examples of such mass storage devices **1328** include floppy disk drives, hard drive disks, compact disk drives, Blu-ray disk drives, RAID systems, and DVD drives.

Coded instructions **1332** corresponding to the instructions of FIG. **10** may be stored in the mass storage device **1328**, in the volatile memory **1314**, in the non-volatile memory **1316**, in the local memory **1313** and/or on a removable tangible computer readable storage medium, such as a CD or DVD **1336**.

At least some of the above described example methods and/or apparatus are implemented by one or more software and/or firmware programs running on a computer processor. However, dedicated hardware implementations including, but not limited to, application specific integrated circuits, programmable logic arrays and other hardware devices can likewise be constructed to implement some or all of the example methods and/or apparatus described herein, either in whole or in part. Furthermore, alternative software implementations including, but not limited to, distributed processing or component/object distributed processing, parallel processing, or virtual machine processing can also be constructed to implement the example methods and/or apparatus described herein.

To the extent the above specification describes example components and functions with reference to particular standards and protocols, it is understood that the scope of this patent is not limited to such standards and protocols. For instance, each of the standards for Internet and other packet switched network transmission (e.g., Transmission Control Protocol (TCP)/Internet Protocol (IP), User Datagram Protocol (UDP)/IP, HyperText Markup Language (HTML), HyperText Transfer Protocol (HTTP)) represent examples of the current state of the art. Such standards are periodically superseded by faster or more efficient equivalents having the same general functionality. Accordingly, replacement standards and protocols having the same functions are equivalents which are contemplated by this patent and are intended to be included within the scope of the accompanying claims.

Additionally, although this patent discloses example systems including software or firmware executed on hardware, it should be noted that such systems are merely illustrative and should not be considered as limiting. For example, it is contemplated that any or all of these hardware and software components could be embodied exclusively in hardware, exclusively in software, exclusively in firmware or in some combination of hardware, firmware and/or software. Accordingly, while the above specification described example systems, methods and articles of manufacture, the examples are not the only way to implement such systems, methods and articles of manufacture. Therefore, although certain example methods, apparatus and articles of manufacture have been described herein, the scope of coverage of this patent is not limited thereto. On the contrary, this patent covers all methods, apparatus and articles of manufacture fairly falling within the scope of the claims either literally or under the doctrine of equivalents.

What is claimed is:

1. A drone dispatching method comprising:

transmitting a flight plan for a drone to a flight control platform associated with a first operator for piloting the drone, the flight plan based on a first location associated with a service request;

in response to receiving a message from the flight control platform indicating the flight plan is approved, initiating, with a processor, a first communication session between the flight control platform and a flight control unit of the drone to permit remote piloting of the drone;

selecting a drone observation platform associated with a second operator based on a subject matter qualification associated with the second operator and descriptive information included in the service request;

in response to receiving the message from the flight control platform indicating the flight plan is approved, initiating, with the processor, a second communication session to exchange multimedia data between the flight control platform and the drone observation platform separate from the flight control platform; and

piloting, using the flight control unit, the drone to the first location based on the flight plan.

2. The method of claim **1**, further including initiating a third communication session between the drone observation platform and a payload unit of the drone, the third communication session to convey sensor data from the payload unit to the drone observation platform and to further convey control data from the drone observation platform to the payload unit to control operation of the payload unit.

3. The method of claim **2**, further including blocking data from being exchanged between the drone observation platform and the flight control unit of the drone via the third

communication session to prevent the remote piloting of the drone via the drone observation platform.

4. The method of claim **3**, further including activating the blocking of data from being exchanged between the drone observation platform and the flight control unit of the drone via the third communication session in response to a command received from the flight control platform.

5. The method of claim **1**, further including adding a communication device to the second communication session to exchange at least a portion of the multimedia data among the flight control platform, the drone observation platform and the communication device.

6. The method of claim **1**, wherein the multimedia data exchanged between the flight control platform and the drone observation platform via the second communication session includes:

voice data exchanged between the flight control platform and the drone observation platform; and

graphical data transmitted from the flight control platform to the drone observation platform, the graphical data based on sensor data received by the flight control platform from a payload unit of the drone via the first communication session.

7. The method of claim **1**, wherein the drone is a first drone included in a fleet of drones, the first drone is located at a second location, and further including:

receiving the service request from a computer aided dispatch system, the service request identifying the first location and including the descriptive information;

selecting the first drone from the fleet of drones based on the descriptive information and a distance between the first location and the second location; and

invoking a mapping application to determine the flight plan to route the first drone from the second location to the first location.

8. The method of claim **7**, wherein the drone observation platform is a first drone observation platform of a plurality of different observation platforms, and further including:

selecting the first drone observation platform from the plurality of different observation platforms based on the descriptive information,

wherein the first operator and the second operator are at different locations.

9. The method of claim **1**, further including, in response to receiving the message from the flight control platform indicating the flight plan is approved, transmitting the flight plan to a computing platform associated with a governmental agency.

10. A non-transitory computer readable storage medium comprising computer readable instructions which, when executed, cause a processor to perform operations comprising:

transmitting a flight plan for a drone to a flight control platform associated with a first operator for piloting the drone, the flight plan based on a first location associated with a service request;

in response to receiving a message from the flight control platform indicating the flight plan is approved, initiating a first communication session between the flight control platform and a flight control unit of the drone to permit remote piloting of the drone;

selecting a drone observation platform associated with a second operator based on a subject matter qualification associated with the second operator and descriptive information included in the service request;

in response to receiving the message from the flight control platform indicating the flight plan is approved, initiating a second communication session to exchange multimedia data between the flight control platform and the drone observation platform separate from the flight control platform; and

enabling piloting, using the flight control unit, the drone to the first location based on the flight plan.

11. The non-transitory computer readable storage medium of claim **10**, wherein the operations further include initiating a third communication session between the drone observation platform and a payload unit of the drone, the third communication session to convey sensor data from the payload unit to the drone observation platform and to further convey control data from the drone observation platform to the payload unit to control operation of the payload unit.

12. The non-transitory computer readable storage medium of claim **11**, wherein the operations further include, in response to a command received from the flight control platform, blocking data from being exchanged between the drone observation platform and the flight control unit of the drone via the third communication session to prevent the remote piloting of the drone via the drone observation platform.

13. The non-transitory computer readable storage medium of claim **10**, wherein the operations further include adding a communication device to the second communication session to exchange at least a portion of the multimedia data among the flight control platform, the drone observation platform and the communication device.

14. The non-transitory computer readable storage medium of claim **10**, wherein the multimedia data exchanged between the flight control platform and the drone observation platform via the second communication session includes:

voice data exchanged between the flight control platform and the drone observation platform; and

graphical data transmitted from the flight control platform to the drone observation platform, the graphical data based on sensor data received by the flight control platform from a payload unit of the drone via the first communication session.

15. The non-transitory computer readable storage medium of claim **10**, wherein the operations further include, in response to receiving the message from the flight control platform indicating the flight plan is approved, transmitting the flight plan to a computing platform associated with a governmental agency.

16. An apparatus for drone deployment, the apparatus comprising:

a memory including computer readable instructions; and

a processor to execute the computer readable instructions to perform operations including:

transmitting a flight plan for a drone to a flight control platform associated with a first operator for piloting the drone, the flight plan based on a first location associated with a service request;

in response to receiving a message from the flight control platform indicating the flight plan is approved, initiating a first communication session between the flight control platform and a flight control unit of the drone to permit remote piloting of the drone;

selecting a drone observation platform associated with a second operator based on a subject matter qualification associated with the second operator and descriptive information included in the service request;

in response to receiving the message from the flight control platform indicating the flight plan is approved, initiating a second communication session to exchange multimedia data between the flight control platform and the drone observation platform separate from the flight control platform; and

enabling piloting, using the flight control unit, the drone to the first location based on the flight plan.

17. The apparatus of claim **16**, wherein the operations further include initiating a third communication session between the drone observation platform and a payload unit of the drone, the third communication session to convey sensor data from the payload unit to the drone observation platform and to further convey control data from the drone observation platform to the payload unit to control operation of the payload unit.

18. The apparatus of claim **17**, wherein the operations further include, in response to a command received from the flight control platform, blocking data from being exchanged between the drone observation platform and the flight control unit of the drone via the third communication session to prevent the remote piloting of the drone via the drone observation platform.

19. The apparatus of claim **16**, wherein the operations further include adding a communication device to the second communication session to exchange at least a portion of the multimedia data among the flight control platform, the drone observation platform and the communication device.

20. The apparatus of claim **16**, wherein the multimedia data exchanged between the flight control platform and the drone observation platform via the second communication session includes:

voice data exchanged between the flight control platform and the drone observation platform; and

graphical data transmitted from the flight control platform to the drone observation platform, the graphical data based on sensor data received by the flight control platform from a payload unit of the drone via the first communication session.

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