A universal interface adapter circuit interfaces, for example, a wireless communications headset with any type of communications system, including those that require push-to-talk (PTT) signaling. The interface adapter is comprised of several main components, including an RF signaling receiver, a microcontroller and associated circuitry for decoding and processing the received signals, and programmable impedance matching and line interfacing circuitry for interfacing a wireless communications headset system base to a communications system. A signaling transmitter, which is preferably portable (e.g., handheld), is employed by the wireless headset user to send signals to the signaling receiver. In an embodiment of the invention directed specifically to push-to-talk (PTT) signaling, the wireless headset user presses a button on the signaling transmitter when they wish to speak. This sends a signal to the microcontroller which decodes the signal and recognizes the signal as being a PTT request. In response, the microcontroller generates a control signal that closes a switch to complete a voice connection between the headset system base and the communications system so that the user can communicate with the communications system. With this arrangement, the wireless headset can be interfaced to any communications system that requires PTT signaling, without modification of the headset device. In addition, the interface adapter can also respond to or deliver any other types of signals, such as dual-tone-multiple-frequency (DTMF) tones, and on/off hook signals. The present invention is also scalable, and permits multiple wireless users to operate independently in the same environment through use of a plurality of the interface adapters.
COMMUNICATIONS INTERFACE FOR WIRELESS COMMUNICATIONS HEADSET

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit under 35 U.S.C. 119(e) of U.S. Provisional Application No. 60/162,089 filed Oct. 28, 1999.

ORIGIN OF THE INVENTION

The invention described herein was made in the performance of work under a NASA contract and by an employee of the United States Government and is subject to the provisions of Section 305 of the National Aeronautics and Space Act of 1958, as amended, Public Law 85-568 (72 Stat. 435, 42 U.S.C. §2457), and may be manufactured and used by or for the Government for governmental purposes without the payment of any royalties thereon or therefore.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a communications interface that enables wireless-communication headsets, or the like, to be used with various types of communications systems, without the need to modify the headsets or the communications systems in use.

2. Description of the Background Art

Various types of portable communications devices are available to facilitate communication between field personnel and a central location. For example, during rocket launches, numerous personnel are stationed around the launch pad, and they must be able to participate in voice communications from a command center. The personnel typically use centralized communications equipment for voice conferencing, portable radios or telephones for this purpose. Two types of portable radios or telephones are particularly suited for such an environment, being wireless and hard-wired communication headsets. In both cases, the units are wearable by the users so that the users can keep their hands free most or all of the time. Generally, wired headsets have a push-to-talk (PTT) device built-in that provides certain communications equipment with a keying signal during transmit. Thus, while a user can continuously hear the communications of others using the system, they must actuate a push button, or the like, when they want to talk on the system. This arrangement is especially desirable where a large number of users are communicating on a single channel, and substantially reduces extraneous background and other noise that would otherwise impede the clarity of the communications.

However, the cords from wired headsets physically cause problems, especially around sensitive flight hardware. Although this problem is solved by wireless headsets, known commercial off-the-shelf (COTS) wireless-communication headsets operate (transmit and receive) continuously, and are not designed to provide any special signaling such as PTT, or external “off hook” or “on hook.” PTT information, for example, is required by many communications systems (especially modern digital systems) to trigger events in the system when the user “keys up” to participate in a voice conference or network, thus making continuous transmission wireless headsets incompatible with such systems.

Continuous transmission impacts analog and digital voice systems differently. In analog systems, amplifiers are continuously active which results in excessive power usage. In addition, inopportune noise is introduced into the voice networks by COTS wireless headsets interfaced to the networks. In digital systems, the operation of the central equipment is impacted while a switch in the equipment considers a wireless headset user as a “continuous talker” into the voice networks. Further, non-PTT communications devices are not even permitted to be used with some communication systems, such as those in use by Department of Defense agencies, law enforcement and public safety (including 911) call centers, air traffic controller operations environments, other mission critical communications environments and even commercial (telemarketing) call centers.

In view of the desirability of using wireless headset type communications devices, a need therefore exists for enabling these devices to be used in applications requiring PTT or other signaling.

SUMMARY OF THE INVENTION

The present invention fulfills the foregoing need through provision of a universal interface adapter circuit that can, for example, interface a COTS wireless communications headset with any type of communications system, including those that require PTT or any other type of signaling. The interface adapter circuit is comprised of several main components, including an RF signaling receiver, and a decoder and control signal generator, that are preferably implemented with a microcontroller, for decoding signals received from the signaling receiver and processing the decoded signals. A programmable or configurable impedance matching and interfacing circuit is also provided for interfacing a COTS headset system base to a communications system. A signaling transmitter, which is preferably portable (e.g., handheld), is employed by the wireless headset user to send encoded signals to the signaling receiver. The signaling transmitter is preferably a low-power auxiliary radio transmitter that is in addition to the radio transmitter of the headset. This permits any one of a number of COTS brands and styles of headsets to be used with the invention interchangeably.

In an embodiment of the invention directed specifically to PTT signaling, the wireless headset user presses a button on the signaling transmitter when they wish to speak. This sends an encoded signal to the microcontroller that decodes the signal and recognizes the signal as being a PTT request. In response, the microcontroller generates a control signal that actuates a relay to close a switch and complete a voice connection between the headset system base and the communications system so that the user can communicate with the communications system. With this arrangement, the COTS wireless headset can be interfaced to any communications system that requires PTT signaling, without modification of a commercial headset device, or selection of a specific commercial wireless headset device. In addition, the interface adapter circuit can also or alternately be configured to respond to or deliver any other types of signals, such as dual-tone-multiple-frequency (DTMF) tones, and on/off hook signals. The present invention also permits multiple wireless users to operate independently in the same environment through use of a plurality of the interface adapter circuits.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the present invention will become apparent from the following detailed description of a number of preferred embodiments thereof, taken in conjunction with the accompanying drawings, in which:
FIG. 1 is a schematic block diagram of a communications interface system that includes a universal interface adapter circuit that is constructed in accordance with a preferred embodiment of the present invention;

FIG. 2 is a schematic block diagram of a circuit for a portable transmitter that is preferably employed with the preferred embodiments;

FIG. 3 is a schematic block diagram of a communications interface system that is constructed in accordance with another preferred embodiment of the present invention, and is configured for using multiple wireless headsets; and

FIG. 4 is a schematic block diagram of the detailed circuitry employed in the universal interface adapter circuit used in the preferred embodiment of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 is a block diagram of a communications interface system 10 that is configured in accordance with a first preferred embodiment of the present invention. The system 10 includes a universal interface adapter circuit 12 that is employed to interface a conventional communications system 14 to a communications device 15 that is not normally compatible with the communications system 14. The communications system 14 can be any type of conventional communications system including, but not limited to, PBX, multiline phone, launch control or other mission-critical communications, call center voice and 911 call center voice systems, for example. In the embodiment illustrated in FIG. 1, the communications device 15 is a commercial-off-the-shelf (COTS) wireless headset. However, it will be understood that the communications device 15 could be any type of communications device that requires special interfacing to be compatible with the communications system 14.

The interface adapter circuit 12 includes an RF signaling (e.g., RS-422) receiver 16, which may be a MAX 485, for example, a microcontroller 18 that decodes signals received by the receiver 16 and generates control signals in response thereto, and a programmable or configurable/alterable interface circuit 22 that is configured to match the impedance of the particular communications system 14 with that of the headset system base 40 to the headset system base 40. As will be discussed in greater detail in conjunction with FIG. 4, the microcontroller 18 can also control the connection of selected ones of the voice lines 46 and 48 through the interface circuit 22. It should also be noted that interface adapter circuit 12 can be integrally formed with the communications system 14.

With respect to FIG. 3, another embodiment of the present invention is illustrated, this one being specifically designed for facilitating communications between a pair of wireless headsets and a pair of corresponding communications systems. Even though FIG. 3 is shown with only two users, the same concepts can be scaled to support any number of users. More particularly, a communications system interface 100 is illustrated in which two of the interface adapter circuits 12 are employed, one to facilitate communications between a first COTS wireless headset 102 and a first communications system 104, and a second to facilitate communications between a second COTS wireless headset 106 and a second communications system 108. The first wireless headset 102 includes a microphone 109, headphones 110 and a transceiver 115 that communicates with a first headset system base 112, while the second wireless headset 106 includes a microphone 113, headphones 114 and transceiver 115 that communicates with a second headset.
A first of the portable signaling transmitters 24 shown in FIG. 2 is associated with the first wireless headset 106, and sends signals on a first channel to a two channel signaling receiver 118. Similarly, a second of the signaling transmitters 24 is associated with the second wireless headset 106, and sends signals on a second channel to the two channel signaling receiver 118. The signaling receiver 118 delivers the signals received on both channels to a combination control signal router and power supply 120, which separates the control signals by channel, and delivers the appropriate signals to each of the interface adapter circuits 12 for processing.

With reference now to FIG. 4, a specific circuit implementation of one of the interface adapter circuits 12 for use with the multiple user embodiment of FIG. 3 is illustrated. It should also be noted that this circuit implementation can also be used with the single user embodiment of FIG. 1. The wireless headset system base 112 or 116 is connected to a connector J2, and the communications system 104 or 108 is connected to a connector J3. Wireless PTT signals or other control signals received from the control signal router/power supply 120 via a connector J1. Power for the interface adapter circuit 12 also enters the circuit via the connector J1. First and second data channel select switches S1A and S1B select which of the wireless data channel sources (portable transmitters 24) will be used for this interface adapter circuit 12. It should be noted that these switches would not be necessary for the single transmitter embodiment of FIG. 1.

A resistor R1 sets the impedance of the balanced differential RS-422 received signals from the control signal router and power supply 120. A resistor R2 buffers the “master clear” function of the microcontroller 18 upon microprocessor power-up. A resistor R3 is a pull-down resistor used to ensure that the port B input on the microcontroller 18 is set to a “low” state (zero volts DC) when the output of the RS-422 receiver 16 is “floating” (i.e., not a clear logic signal). A crystal oscillator 127 provides a reliable clock source for the microcontroller 18. A capacitor C1 ensures a stable positive supply voltage for logic comparisons within the microcontroller 18, and a stable supply for the relay 125. An isolation transformer 128 is provided to couple transmit audio to J3 and provide a return current path to the communications system if required. A voltage regulator 130 provides regulated DC power to the low power RS-422 receiver 16.

In conclusion, the universal interface adapter circuit 12 can be used to interface a COTS wireless communications headset, or any other type of communication device, with any type of communications system, including those that require PTT or any other type of signaling. This is made possible by the microcontroller 18 and the impedance matching and line interfacing circuit 22 that enables selective programming or configuration of the interface adapter circuit 12 to accommodate any type of communications system requirements. In addition, the provision of the portable signaling transmitter 24 for sending selective control signals to the microcontroller 18 permits any one of a number of COTS brands and styles of headsets, or other communication devices, to be used with the invention interchangeably.

Although the invention has been disclosed in terms of a number of preferred embodiments and variations thereof, it will be understood that numerous additional variations and modifications could be made without departing from the scope of the invention as defined in the following claims.

We claim:

1. A communications interface system for facilitating communications between a communications system and a communications device comprising:
   a) a signaling transmitter for generating and transmitting encoded signals; and
   b) an interface adapter circuit for interfacing a communications system with a communication device, said interface adapter circuit including:
1) a signaling receiver for receiving said encoded signal from said signaling transmitter;
2) a decoder and control signal generator for decoding said received signals and generating control signals in response thereto;
3) an impedance matching and line interface circuit for interfacing a communications system to a communication device, said impedance matching and line interface circuit being controllable in response to said control signals; and
4) said impedance matching and line interface circuit including a programming terminal block including a plurality of terminals for selectively connecting one or more external electrical components to said circuit for selectively programming said impedance matching and line interface circuit.

2. The communications interface system of claim 1, wherein said signaling transmitter includes a transmitter module and a switch connected to said module for causing said module to transmit an encoded signal.

3. The communications interface of claim 2, wherein said signaling transmitter further includes a keypad connected to said module for causing said module to transmit a plurality of different encoded signals.

4. The communications interface system of claim 1, wherein said decoder and control signal generator generates a push-to-talk control signal in response to receipt of an encoded signal from said transmitter, and said impedance matching and line interface circuit further includes a switch for selectively connecting one or more voice lines from a communication device to a communications system in response to said push-to-talk control signal.

5. The communications interface system of claim 4, further including:
   a) said wireless headset communication device;
   b) a wireless headset base for sending voice communications to, and receiving voice communications from, said wireless headset communication device, said base being interfaced to said adapter interface circuit; and
   c) a communications system interfaced to said adapter interface circuit,
   whereby, said signaling transmitter sends a push-to-talk request to said receiver in said adapter interface circuit, and said decoder and control signal generator generates a push-to-talk control signal so that said switch in said impedance matching and line interface circuit will connect one or more voice lines from said wireless headset base to said communications system in response to said push-to-talk request.

6. The communications interface system of claim 1, wherein said decoder and control signal generator comprises a microcontroller.

7. The communications interface system of claim 1, wherein said decoder and signal generator comprises a microcontroller that generates a push-to-talk control signal in response to receipt of an encoded signal from said transmitter, and said impedance matching and line interface circuit further includes a programming terminal block including a plurality of terminals for selectively connecting one or more external electrical components for selectively programming said impedance matching and line interface circuit, and a switch for selectively connecting one or more voice lines from a communication device to a communications system in response to said push-to-talk control signal, and said interface system further includes:
   a) a wireless headset communication device;
   b) a wireless headset base for sending voice communications to. And receiving voice communications from, said wireless headset communication device, said base being interfaced to said adapter interface circuit; and
   c) a communications system interfaced to said adapter interface circuit
   whereby, said signaling transmitter sends a push-to-talk request to said receiver in said adapter interface circuit, and said decoder and control signal generator generates a push-to-talk control signal so that said switch in said impedance matching and line interface circuit will connect one or more lines from said wireless headset base to said communications system in response to said push-to-talk request.

8. A communications interface system for facilitating communications between a plurality of communications systems and a plurality of communication devices comprising:
   a) first and second communications systems;
   b) first and second communication devices;
   c) first and second signaling transmitters for generating and transmitting encoded signals, said first signaling transmitter being assigned to a first transmission channel, and said second signaling transmitter being assigned to a second transmission channel;
   d) a first interface adapter circuit for interfacing said first communications system with said first communication device, said first interface adapter circuit including:
      1) a signaling receiver for receiving said encoded signals from said first signaling transmitter;
      2) a decoder and control signal generator for decoding said received signals and generating control signals in response thereto; and
      3) an impedance matching and line interface circuit for interfacing said first communications system to said first communications device, said impedance matching and line interface circuit being controllable in response to said control signals; and
   e) a second interface adapter circuit for interfacing said second communications system with said second communication device, said second interface adapter circuit including:
      1) a signaling receiver for receiving said encoded signals from said second signaling transmitter;
      2) a decoder and control signal generator for decoding said received signals and generating control signals in response thereto; and
      3) an impedance matching and line interface circuit for interfacing said second communications system to said second communications device, said impedance matching and line interface circuit being controllable in response to said control signals.

9. The communications interface system of claim 8, wherein said signaling transmitters each include a transmitter module and a switch connected to said module for causing said module to transmit an encoded signal.

10. The communications interface system of claim 8, wherein said signaling transmitter further includes a keypad connected to said module for causing said module to transmit a plurality of different encoded signals.

11. The communications interface system of claim 8, wherein each of said decoding and controlling signal generators generates a push-to-talk control signal in response to receipt of an encoded signal from said transmitter, and each of said impedance matching and line interface circuits further includes a switch for selectively connecting one or more lines from a corresponding one of said communication devices to a corresponding one of said communications system in response to said push-to-talk control signal.
12. The communications interface system of claim 11, wherein said communication devices comprises first and second wireless headset communication devices and first and second corresponding wireless headset bases for sending voice communications to, and receiving voice communications from, said wireless headset communication devices, said bases interfac ed to said first and second adaptor interface circuits, respectively;

whereby, said signaling transmitters send push-to-talk requests to said receivers in said adapter interface circuits, and said decoder and control signal generators generate push-to-talk control signals so that said switches in said impedance matching and line interface circuits will connect one or more voice lines from said wireless headset bases to said communications systems in response to said push-to-talk requests.

13. The communications interface system of claim 8, wherein said decoder and signal generators each comprise a microcontroller.

14. The communications interface system of claim 8, wherein each said impedance matching and line interface circuit includes a programming terminal block including a plurality of terminals for selectively connecting one or more external electrical components to said impedance matching and line interface circuits for selectively programming said circuits.

15. The communication interface system of claim 8, wherein each said decoder and generator comprises a microcontroller that generates a push-to-talk control signal in response to receipt of an encoded signal from a corresponding one of said transmitters, and each said impedance matching and line interface circuit further includes a programming terminal block including a plurality of terminals for selectively connecting one or more external electrical components to said impedance matching and line interface circuits for selectively programming said circuits, and a switch for selectively connecting one or more voice lines from a corresponding one of said communication devices to a corresponding one of said communications systems in response to said push-to-talk control signals, and

wherein said communication devices comprise first and second wireless headset communication devices and first and second corresponding wireless headset bases for sending voice communications to, and receiving voice communications from, said wireless headset communication devices, said bases being: interfac ed to said first and second adaptor interface circuits, respectively;

whereby, said signaling transmitters send push-to-talk requests to said receivers in said adapter interface circuits, and said decoder and control signal generators generate push-to-talk control signals so that said switches in said impedance matching and line interface circuits will connect or more voice lines from said wireless headset bases to said communications systems in response to said push-to-talk requests.

16. A method for facilitating communications between a communications system and a communication device comprising the steps of

a) providing a user of said communication device with a signaling transmitter for generating and transmitting encoded signals;

b) providing an interface adapter circuit for interfacing said communications system with said communication device, said interface adapter circuit including an impedance matching and line interface circuit for interfacing said communications system to said communication device;

c) generating and transmitting an encoded signal with said signaling transmitter;

d) receiving said encoded signal with a signaling receiver in said interface adapter circuit;

e) decoding said encoded signal and generating a control signal in response thereto;

f) employing said control signal to control said impedance matching and line interface circuit, said block including a plurality of terminals, and selectively connecting one or more external electrical components to said terminals for selectively programming said impedance matching and line interface circuit.

17. The method of claim 16, wherein said steps of decoding said encoded signal and generating a control signal in response thereto, and employing said control signal to control said impedance matching and line interface circuit further comprise generating a push-to-talk control signal, and applying said push-to-talk control signal to a switch in said impedance matching and line interface circuit for selectively connecting one or more voice lines from said communication device to said communications system in response to said push-to-talk control signal.

18. The method of claim 17, wherein said communication device comprises a wireless headset communication device, and a wireless headset base for sending voice communications to, and receiving voice communications from, said wireless headset communications device, said wireless base being interfaced to said adapter interface circuit.