

The background is a dark blue space scene. In the upper left, a large, grey, cratered Moon is visible. In the upper right, a reddish-brown planet, likely Mars, is shown. A bright yellow starburst is in the top right corner, and a blue starburst is in the top left. A white rocket with orange boosters is in the bottom left, angled upwards. A purple orbital path curves across the scene. The main title is in large white text, and a yellow horizontal line is below it.

Preparation for an Earth Independent Medical Operations Demonstration using the Tempus ALS™ Medical Device

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Evolution of Tech Demo Plans:

Preparation for an Earth Independent
Medical Operations (EIMO) Demonstration
using the ~~Tempus ALS™ Medical Device~~

Multi-functional Integrated Medical (MIM)
Devices

The Tech Demo Collaboration



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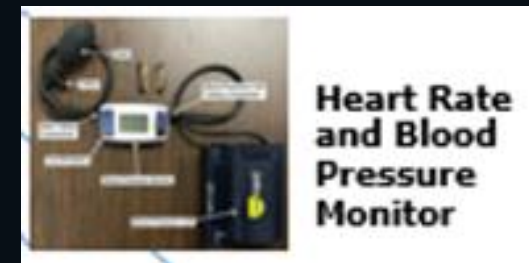
Kimesha Calaway
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Russell Valentine

Tech Demo Specific Aims:

1. Determine the efficiency of using a multi-functional integrated medical device instead of a suite of individual devices
2. Determine the feasibility of including a multi-functional integrated medical device within an exploration medical system
3. Simulate Earth Independent Medical Operations (EIMO) on ISS while using a multi-functional integrated medical device and communication delays of different lengths

Aim 1: Multi-functional Medical Device Efficiency

- Currently on ISS, the Crew Health Care System (CHeCS) consists of individual medical devices for vital sign monitoring, ultrasound imaging, inner ear exams, etc.
- A multi-functional integrated medical device may improve medical care efficiency over the current suite of individual devices
- The multi-functional integrated medical devices under investigation include:
 - Tempus ALS™ (Remote Diagnostic Technologies, Ltd., Philips Corp, Farnborough, UK)
 - LifeBot® (LifeBot Health, Chicago, IL)



About the Tempus ALS™* Device

- Multi-parameter vital signs monitor (ECG, blood pressure, SpO2, etCO2, temperature, etc.)
- Ultrasound imaging and video laryngoscopy
- Tempus LS defibrillator module
- Procedural guidance (iAssist)
- Data capture and transmission
- Communication capabilities

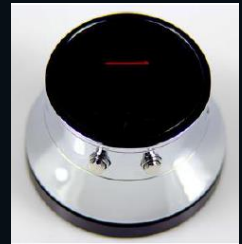


*Remote Diagnostic Technologies, Ltd., Philips Corp, Farnborough, UK

About LifeBot®* Devices

- Multi-parameter vital signs monitor (ECG, blood pressure, SpO2, etCO2, temperature, etc.)
- Defibrillation, ultrasound, digital stethoscope, otoscope, eye exam camera, dermatoscope, and video laryngoscopy
- Data management of patient call reports and electronic health records
- On-board audio, video and data communications capabilities

















*LifeBot Health, Chicago, IL



Aim 1: Multi-functional Medical Device Efficiency

Tempus ALS™ ISS Tech Demo: Phase I – ESA led

1. The Health Maintenance System (HMS) Periodic Health Status (PHS) Exam is performed nominally and then with the Tempus ALS™
 - Time to complete the PHS exams is collected
2. A nominal Medical Contingency Drill is performed. Operators determine the Tempus ALS™ capabilities that could enhance medical contingency management
 - User experience feedback is collected

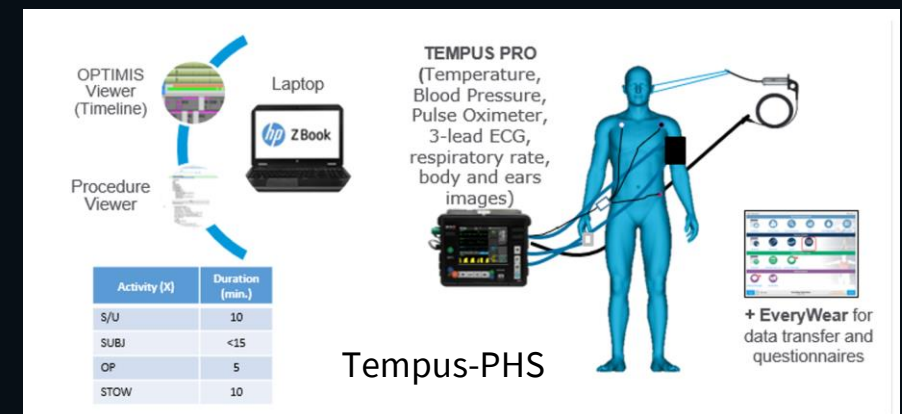
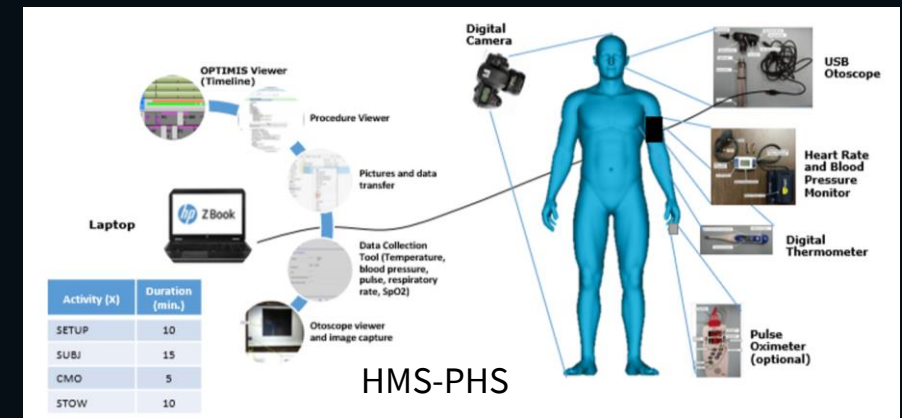
<u>TEMPUS-PHS:</u>		<u>TEMPUS-CNTGCY-DRILL:</u>	
Peripherals:	 Tempus PRO	Peripherals:	 Tempus LS
	• Reusable NIBP Cuffs		• Headset with push-talk cable
	• Reusable Contact Temp Probe		• USB Abdominal and Vascular Ultrasound Probe
	• 3&12 ECG Modular Trunk Cable (AAMI)		
	• Karl Storz C-MAC S Imager Video		
	• Masimo Rainbow M-LNCS Trunk Cable	Consumables:	
	• Masimo Rainbow DCI Reusable Sensor		• Adult Pacing & Defibrillation Electrodes for the Tempus LS (<i>Inspected not used</i>)
Consumables:			• Video Laryngoscope D Blade Disposable (<i>Inspected not used</i>)
	• Ambu® BlueSensor® Electrodes		• EtCO2 Smart Capnoline & Smart Capnoline Plus
	• BZK wipes (for cleaning reusable sensors)		

Aim 1: Multi-functional Medical Device Efficiency

Tempus ALS™ ISS Tech Demo: Phase I – ESA Led

- Use the time to complete comparison to determine increases in efficiency
- Use the user experience feedback to determine user preferences

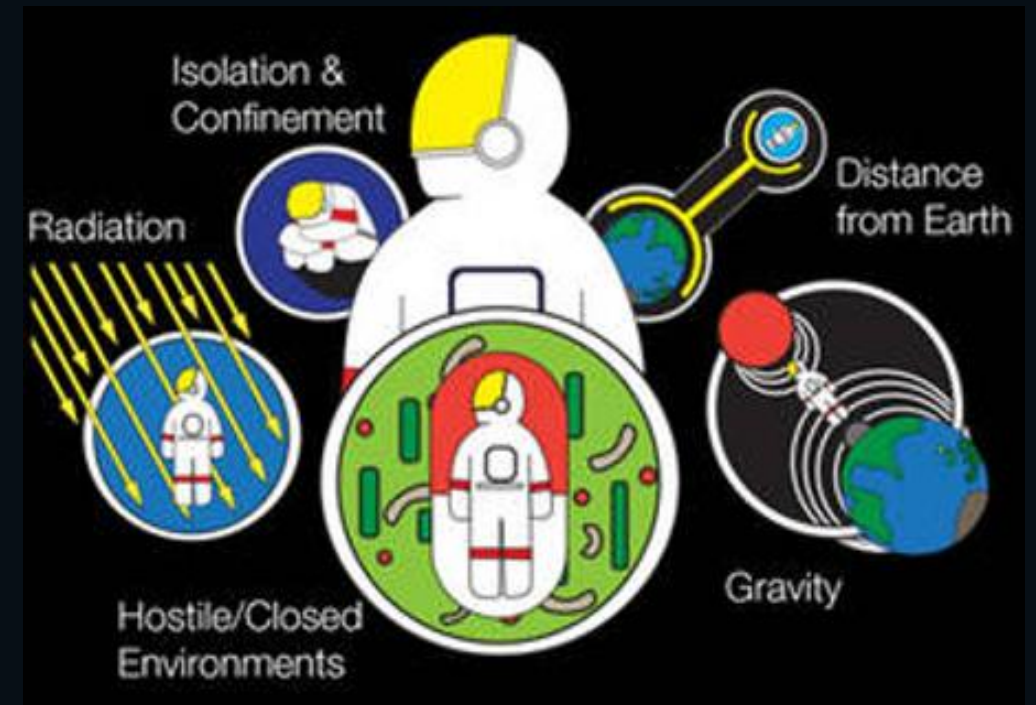
Comparison of the Tempus-PHS to the HMS-PHS



Aim 2: Feasibility of Inclusion in an Exploration Medical System

Exploration Medical Systems will need to:

- Operate within a variety of gravitational fields
- Operate within alternate atmospheric environments (e.g., high O₂, low pressure)
- Fit within severely limited mass, volume, and power constraints
- Consider the limited opportunities for resupply
- Consider the limited capability for medical evacuation



Aim 2: Feasibility of Inclusion in an Exploration Medical System

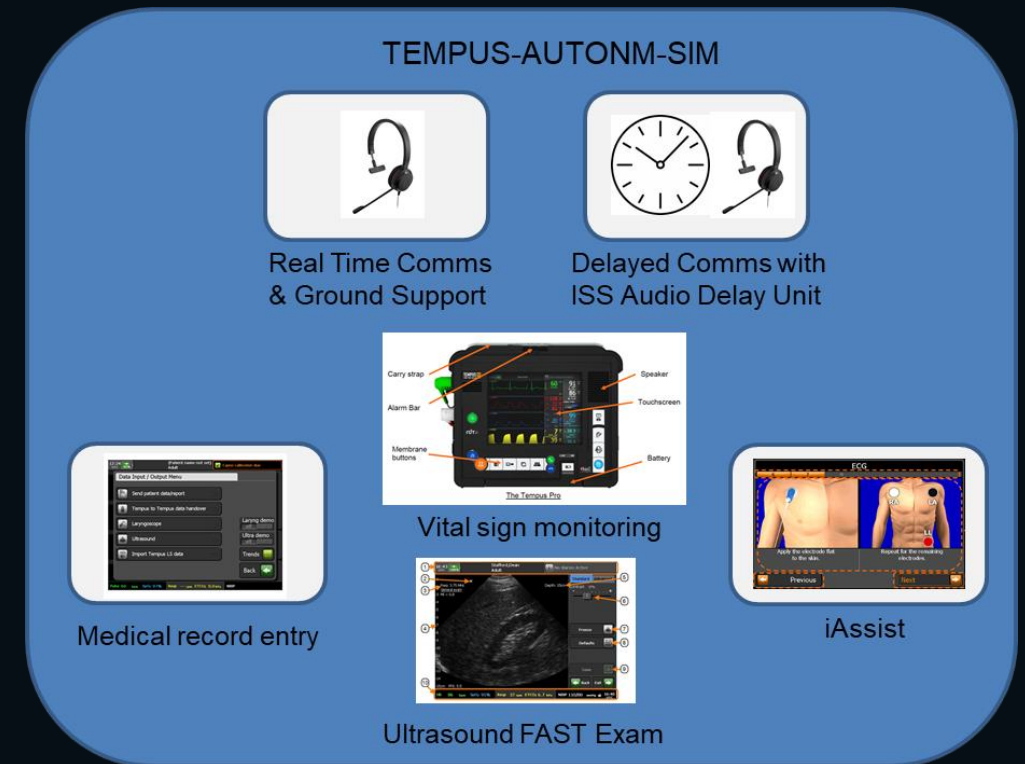
- Perform demonstrations of multi-functional devices:
 - Tempus ALS™
 - LifeBot®
- Demonstrations will include:
 - Ground testing
 - Testing within the Exploration Atmospheres Chamber
 - Testing on ISS
 - Investigate the ability to integrate with Crew Health and Performance – Integrated Data Architecture (CHP-IDA)
- Determine:
 - Device functionality in a high oxygen/low pressure atmosphere
 - Device functionality and ease of use in a microgravity environment
 - User experience and preferences
- Use lessons learned to aid development of an exploration medical system



Aim 3: Simulate Earth Independent Medical Operations on ISS

Tempus ALS™ ISS Tech Demo: Phase II – NASA led

- The caregiver is presented with a medical scenario, where the patient complains of flank pain
- The caregiver enters medical information, collects vital signs and performs an ultrasound exam
- Trials are performed with real time communication or delayed communications using various communication platforms
- Procedural guidance is available to the caregiver



Aim 3: Simulate Earth Independent Medical Operations on ISS

- Explore different procedural guidance platforms
- Simulate different communications situations:
 - Use different lengths of audio or video delay
 - Real time
 - On the order of seconds
 - On the order of minutes
 - No communications
 - Trial different types of communication platforms for determination of the most effective method of transmission for medical care advice/instruction
- Use lessons learned to aid development of an exploration medical system

2.0.301 PROCEDURE - VITAL SIGNS
(MED CL/E44 - ALL/FIN 3/T) Page 1 of 2 pages

OBJECTIVE:

To collect vital signs.

ITEMS:

SSC

Medical Diagnostic Pack:

- Thermometer
- Blood Pressure Cuff (select appropriate size)
- Blood Pressure Monitor

Medical Supply Pack:

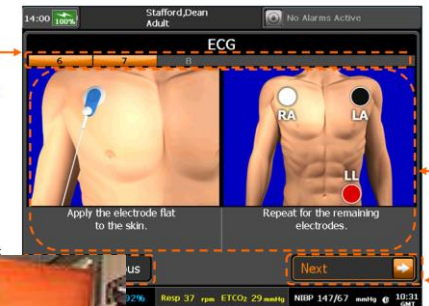
BZK Wipe

1. OPENING DATA

SSC

Press [F4]
input: Data Col
Press [ENTER]

The strip shows that the number of steps in the process and the steps that are being displayed



Follow the on-screen written and graphical instructions

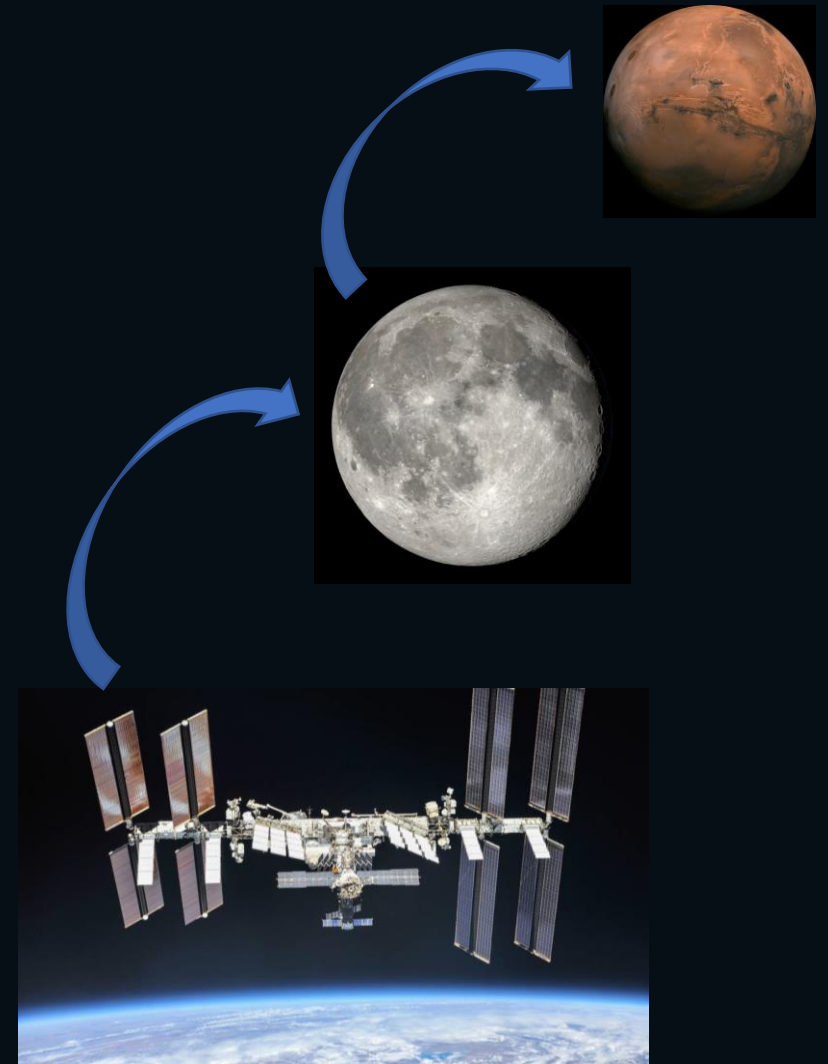
Press here when the instructions have been completed



Example of an iAssist process

Conclusion

- NASA's exploration missions will require medical systems that provide Earth independent medical care
- The ISS provides a validation platform for candidate exploration medical devices
- Multifunctional medical devices will be demonstrated on the ground, in the exploration atmospheres chamber, and on ISS and evaluated for exploration mission feasibility
- EIMO lessons learned will be incorporated into exploration medical system development





Thank you!
Questions?
