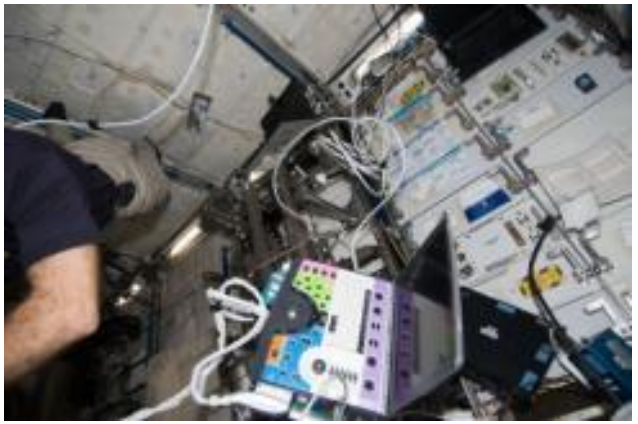
Ultrasound 2 Remote Guidance Overview

Human Research Program

Overview

- **The following slides will provide:**
  - **Description of Remote Guidance**
  - **Overview of Ultrasound 2 keyboard and probes**
  - **Remote Guider Communication**
  - **Remote Guider best practices**



Remote Guidance

- **"Remote Guidance" enables ISS crewmembers (astronauts and cosmonauts) who may not have a medical background to obtain high quality data using HRP's Ultrasound 2.**
  - » Precise positioning of ultrasound probes on the Subject's body
  - » Use of buttons on keyboard to adjust settings and capture images
- **Successfully used for research and medical activities:**
  - **HRP experiments such as Fluid Shifts, Ocular Health, Cardio Ox, Sprint, Spinal Ultrasound, and Integrated Cardiovascular (ICV)**
  - **Medical eye scans**
  - **CSA uses HRP Ultrasound 2 for Vascular Echo with Remote Guidance from Canada.**

Remote Guidance

- **Participants:**
  - **"Remote Guider"**
    - » Trained sonographer who sits on-console in the HRP Telescience Support Center (TSC) in MCC and directs the crewmembers in the use of the Ultrasound 2 system to accomplish the objectives.
  - **One or two Crewmembers, depending on type of scan and crewmember preference**
    - » Subject, who may perform a self-scan
    - » Operator to use the probe on the Subject and/or operate the Ultrasound 2 keyboard.
  - **HRP Ops team in the TSC**
    - » Interface with POIC and assist the Remote Guider in managing the session time/objectives
    - » Set up privatized voice and restricted video for confidentiality

Remote Guidance

- **Implementation:**
  - **Cabin video for Remote Guider to see position of crewmember and USND 2 probe**
  - **Direct video of USND 2 screen so Remote Guider sees the same images the crew sees.**
  - **Voice loop for communication between Remote Guider and participating crewmembers**
    - » **Positioning the crewmember so he can reach the keyboard, see the monitor easily, and reach the subject without stretching**
    - » **Adjusting cabin camera field of view**
    - » **Instructions to position the probe on the subject's body**
    - » **Instructions on which buttons to press on the USND 2 keyboard**
    - » **Steps to manage data after the session**

***Note*: Pre-flight training sessions provide practice with Remote Guider**

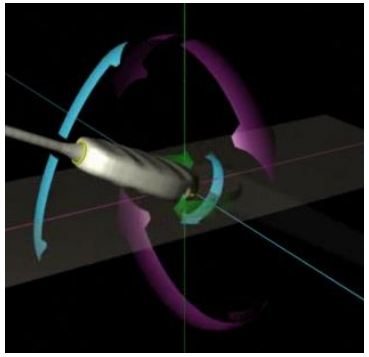
Most effective when assigned Subject and Operator train together

Ultrasound 2 Keyboard Overlay

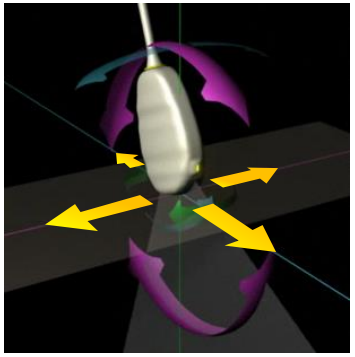
- **A keyboard overlay was designed to aid crew during remote guidance activities.**
  - **The keyboard is divided into functional areas; each area is assigned a different color**
  - **Buttons within each area are assigned a specific number**
  - **Note: Gain and "keyboard" areas have original labels**
  - **Remote Guidance Call out:** ***[Color] [Number] [Direction (if needed)]*** (Example: Purple 4 Down)

Ultrasound 2 Probes

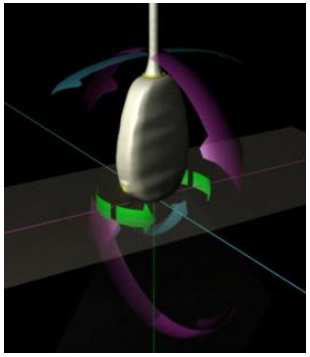
- The reference marker is a ridge or an LED light on the probe that defines the rotation of the probe.
- Directions are given to tilt, slide, or rotate the probe to the desired position



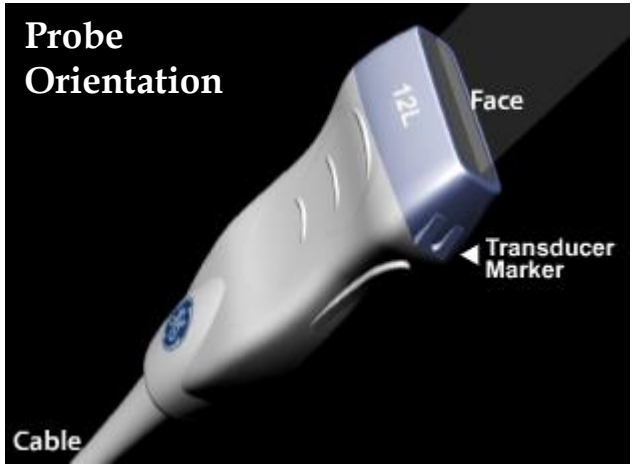
Tilt
(blue arrows)



Slide
(yellow arrows)



Rotate
(green arrows)



Remote Guider Communication

These slides provide standard terminology, but actual remote guidance may change based on the unique ultrasound scan objectives or the crewmember

Keyboard Overlay callouts:

- ***"Press [Color] [Number] [Direction (if needed)] [Amount (if needed)]"***
  - Examples:
    - "Press Purple 4 down"
    - "Press Blue 2 down two clicks" (to increase depth)
    - "Press Physio. Now press Purple 3 down. Press Green 7." (to enable/disable ECG and return to normal screen)
- **Be as specific as possible**
  - Example when giving instruction on the gain knob:
    - ***Instead of saying, "Turn the gain up," say "Turn the 2D gain 2 clicks to the right."***

Remote Guider Communication

Keyboard (continued)

- **If not using Keyboard Overlay callouts, discuss with crew prior to starting scan**
  - Example:
    - » "For this scan, we would like to use 'Freeze' instead of 'Brown 2' and 'Store' instead of 'Brown 1'"
- **When referencing items with letter, it is best practice to use the phonetic alphabet** (See Backup slides)
  - B, C, D, E, and G can sound the same.
  - Alpha, Bravo, Charlie, Delta, etc. are less ambiguous.

Remote Guider Communication

Probes

- **Standard terminology:**
  - **Tilt (refer to the "cable end of the probe"):** *"Tilt the cable end of the probe toward your right shoulder, left hip, etc."*
  - **Slide:** *"Slide the probe up one rib space"*
  - **Rotate (refer to the "reference marker"):** *"Rotate the probe so that the reference marker is pointing toward your right side"*
- **It is helpful to use the subject's body as a reference for probe manipulation**
  - Example:
    - » ***Instead of saying, "Slide the probe down," which can be ambiguous, specify toward or away from a shoulder, hip, feet, head, or back.***

Remote Guider Communication

<u>Probes</u> (continued)

- **Be as specific as possible and try to quantify each instruction**
  - **Use degrees for angles**
  - **Metric is preferred for distance since many astronauts are international**
  - Examples:
    - » *Instead of saying, "Move the probe a little to the left", say "Slide the probe a centimeter to the left"*
    - » *"Tilt the cable end of the probe 10 degrees toward the head or toward the feet"*
- **It is more efficient to say "rotate the reference marker left, right, up, down" rather than using clockwise or counterclockwise**

Remote Guider Communication

Probes (continued)

- **Providing remote guidance on pressure is difficult**
  - Examples:
    - » **Less pressure:** *"Pull away from the (eyelid/skin) to float the probe".*
    - » **More pressure:** *"Press down on the probe. Use ___ pounds of pressure."*
- **Define the "subject" and the "operator"**
  - **Sometimes the subject is also the operator (self-scan). Other times, the remote guider must communicate with both. It is a good idea to call out each by either their name or as subject or operator.**
    - » **If Scott is self-scanning:** *"Scott, rotate the probe reference marker to your right".*
    - » **If Scott is now the operator and the subject is in front of him:** *"Scott, rotate the probe reference marker to the subject's right".*

Remote Guider Communication

Probes (continued)

- **Simple instructions are typically best. Avoid medical terminology unless the scanner has a medical background and is comfortable with the terminology.**
  - **Examples:**
    - *lateral, medial, apex, or cephalad*
    - *Generally, it is better NOT to mention left and right ventricles by name since their position on the screen (LV on right and RV on left) could clearly confuse the scanner. Instead, it is preferred to say, "Chamber on the right (or left)."*

Remote Guidance Best Practices

- **Give instructions clearly and definitively**
  - Effective communication is essential to safety and mission success
- **Always maintain a positive attitude with the scanner**
  - If they pick up that you are frustrated, they will likely become frustrated, or lose confidence in your instruction.
- **Speed is a virtue**
  - With a flight session, there will always be a limited amount of time available.
  - If there is a good image, grab it fast and push on to the next view.
  - That is not to say quality should be compromised.
- **Take advantage of targets of opportunity**
  - If you are trying to acquire one view in the protocol and another one pops up, take it.
- **When an image is unrecognizable**
  - Start by confirming the probe position and rotation with the scanner.

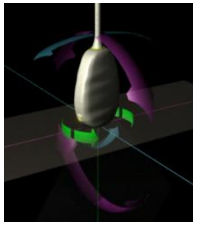
Remote Guidance Best Practices:
Holding the Probe Properly

- It is often helpful to remind the crewmember to hold the probe at the bottom, as one would hold a pen with the little finger and heel of the hand on the subjects body. The advantages of holding the probe properly are:
  - This helps keep the probe from sliding on the skin.
  - Hand and/or arm fatigue is reduced, which can be a factor in image quality.
  - Manipulating the probe with the fingers allows for more fine motor control.
  - If the hand is not anchored on the subject's body, it will take more pressure on the probe to maintain position, making the procedure less attractive to the subject.

BACKUP SLIDES

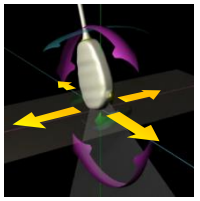
Notes on Probe Positioning Guidance

- Instructions should be given as "rotate the probe clockwise" or "counter clockwise". By convention, clockwise or counter-clockwise would be as viewed from another person, or as though the skin is the face of a clock. For example, to go from a parasternal long axis cardiac view to a parasternal short axis view, the probe should be rotated 90 degrees clockwise.



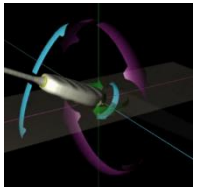
Rotate
(green arrows)

- Directions for transducer placement or movement should be given in reference to the subject's anatomy whenever possible. Moving the probe would be stated as “toward the subject's left side”, or “toward the head”, etc. However, if the crewmember is having trouble understanding those instructions, other landmarks can be used, including landmarks in the cabin (starboard, port, up, down).



Slide
(yellow arrows)

- Creating the angle of the probe should be accomplished in the same fashion (using anatomic landmarks), and should use the cable end of the probe as a reference. For example, on a longitudinal view of a carotid artery, the probe could need to be “tilted toward the back or front of the subject”, assuming the rotation is correct). Going from a parasternal long axis of the right heart to the left heart would entail “tilting the cable end toward the subject's right hip”.



Tilt
(blue arrows)

Phonetic Alphabet

A - Alpha	N - November
B - Bravo	O - Oscar
C - Charlie	P - Papa
D - Delta	Q - Quebec
E - Echo	R - Romeo
F - Foxtrot	S - Sierra
G - Golf	T - Tango
H - Hotel	U - Uniform
I - India	V - Victor
J - Juliet	W - Whiskey
K - Kilo	X - x-ray
L - Lima	Y - Yankee
M - Mike	Z - Zulu

When needed for clarity, the phonetic alphabet will be used.

Russian Phonetic Spelling Alphabet

Rus Ltr	English Sound	Cyrillic Phonetic	English Equivalent		Rus Ltr	English Sound	Cyrillic Phonetic	English Equivalent
А	ah	Анна	Anna		Р	err	Роман	Roman
Б	beh	Борис	Boris		С	ess	Семён	Semyon
В	veh	Василий	Vasily		Т	the	Татьяна	Tatiana
Г	geh	Григорий	Gregory		У	oo	Ульяна	Ulyana
Д	deh	Дмитрий	Dmitri		Ф	eff	Фёдор	Fyodor
Е	yeh	Елена	Yelena		Х	khah	Харитон	Khariton
Ё	yoh	(no entry)			Ц	ts	Цапля	Tsaplya
Ж	zheh	Женя	Zhenya		Ч	ch	Человек	Chelovek
З	zeh	Зинаида	Zinaida		Ш	sh	Шура	Shura
И	ee	Иван	Ivan		Щ	shch	Щука	Schuka
Й	eeye	Иван краткий	Ivan kratky		Ъ	n/a	Твёрдый знак	Tvordi znak
К	kah	Константин	Constantine		Ы	ooee	Еры	Yerui
Л	el	Лионид	Leonid		Ь	n/a	Мягкий знак	Myaki znak
М	em	Михаил	Mikhael		Э	eh	Эхо	Ekho
Н	en	Николай	Nikolai		Ю	you	Юрий	Yuri
О	oh	Ольга	Olga		Я	ya	Яков	Yakov
П	peh	Павел	Pavel					