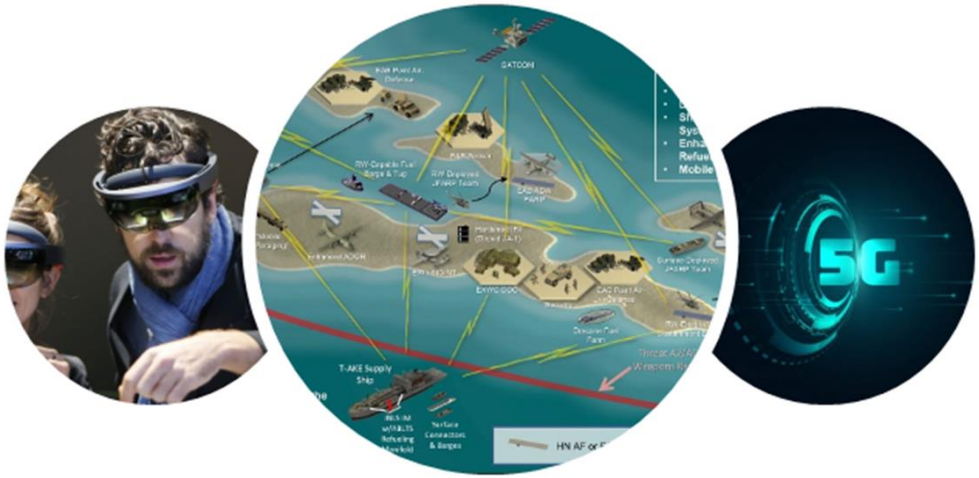
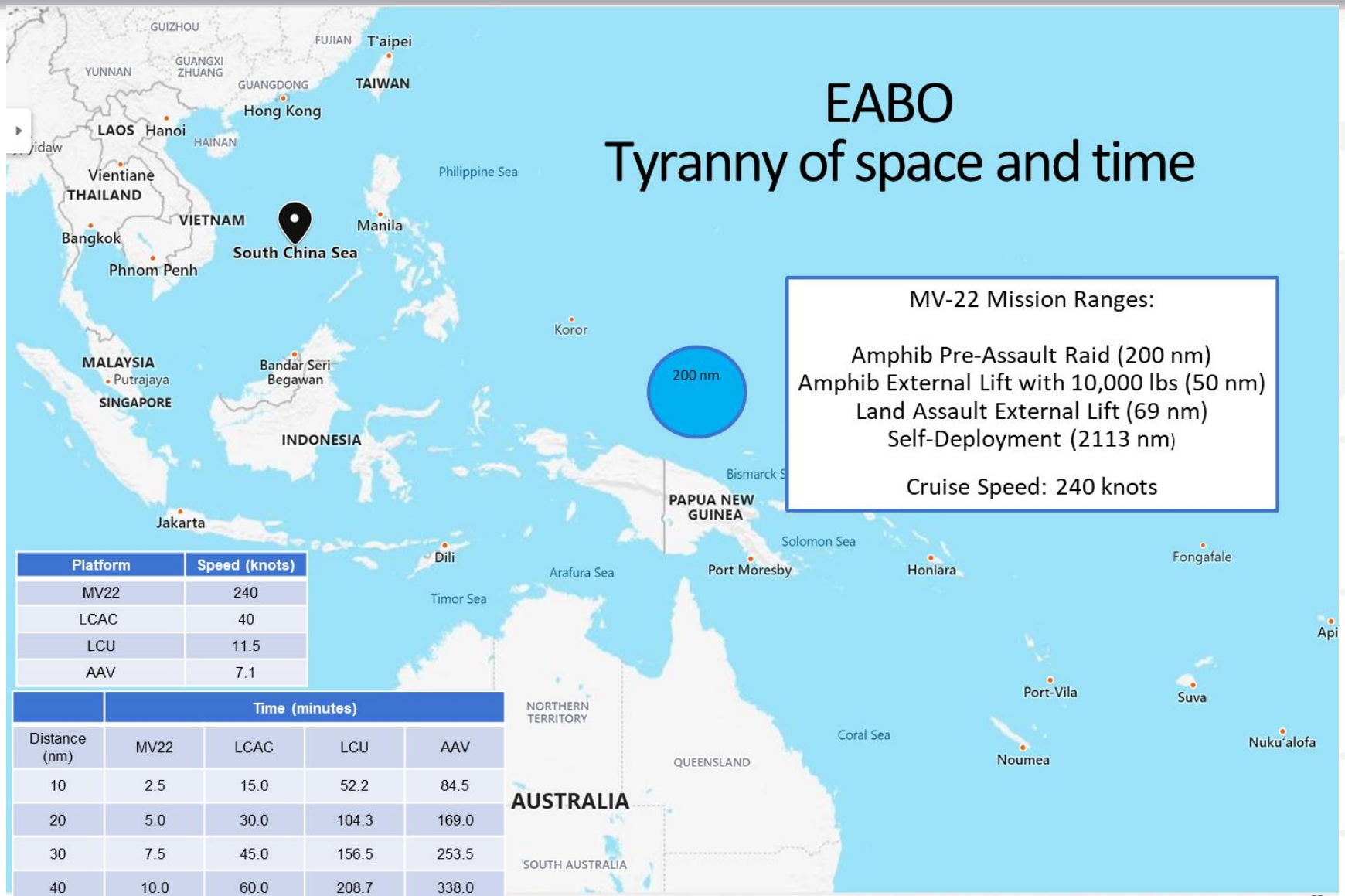
Enhanced Corpsman to Hospital Optical System (ECHOS)



EABO
Tyranny of space and time



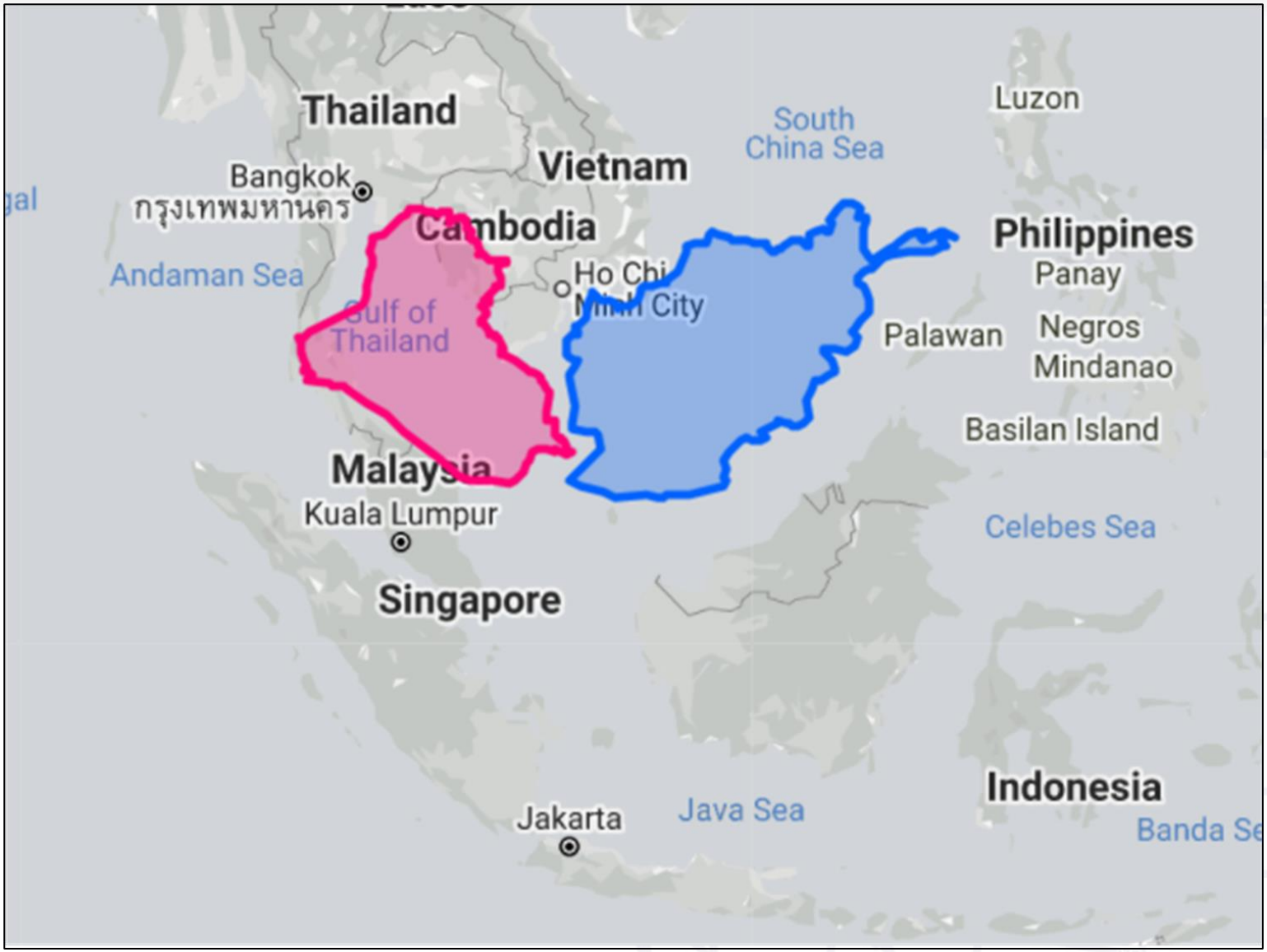
MV-22 Mission Ranges:

Amphib Pre-Assault Raid (200 nm)
Amphib External Lift with 10,000 lbs (50 nm)
Land Assault External Lift (69 nm)
Self-Deployment (2113 nm)

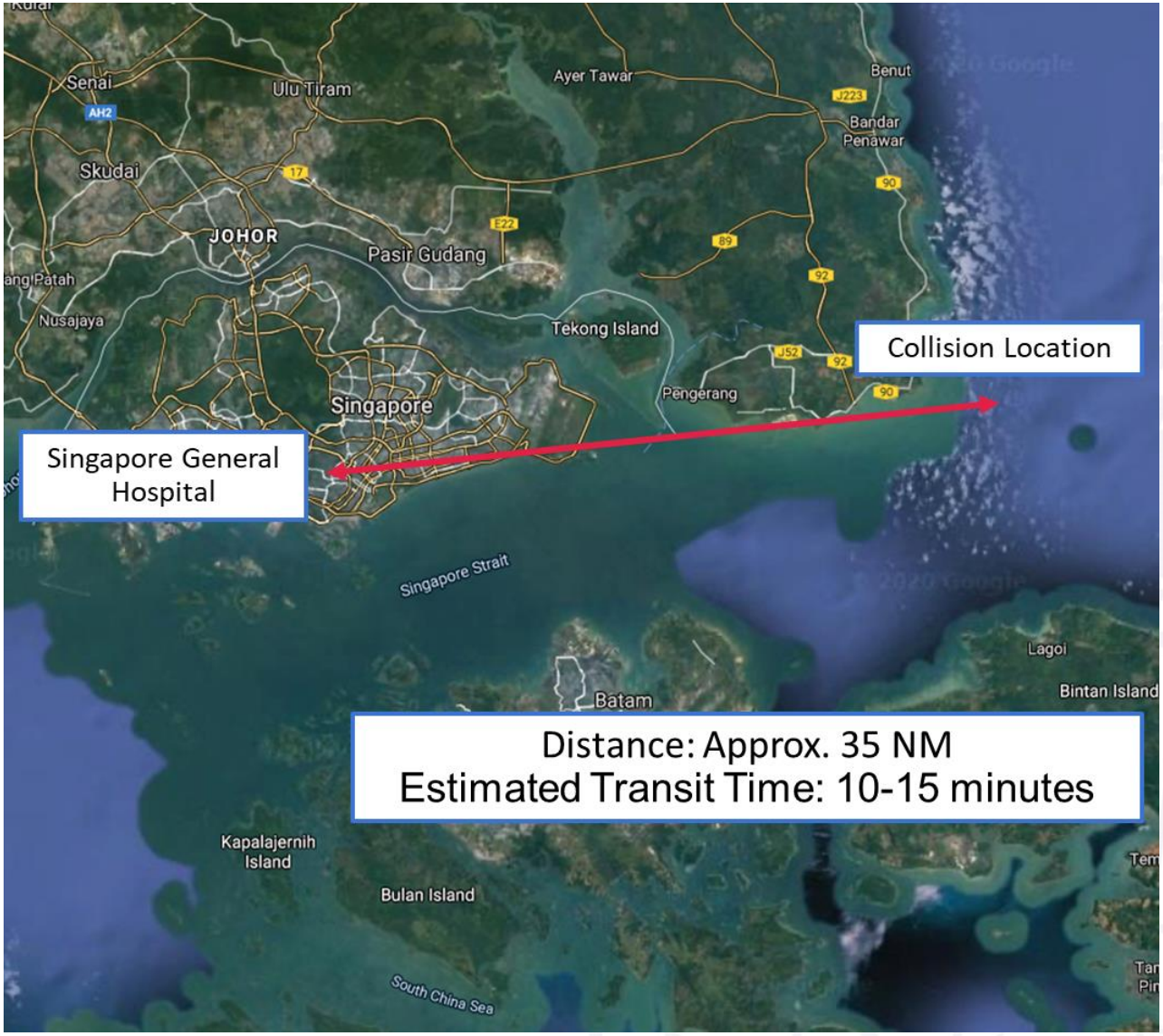
Cruise Speed: 240 knots

Platform	Speed (knots)
MV22	240
LCAC	40
LCU	11.5
AAV	7.1

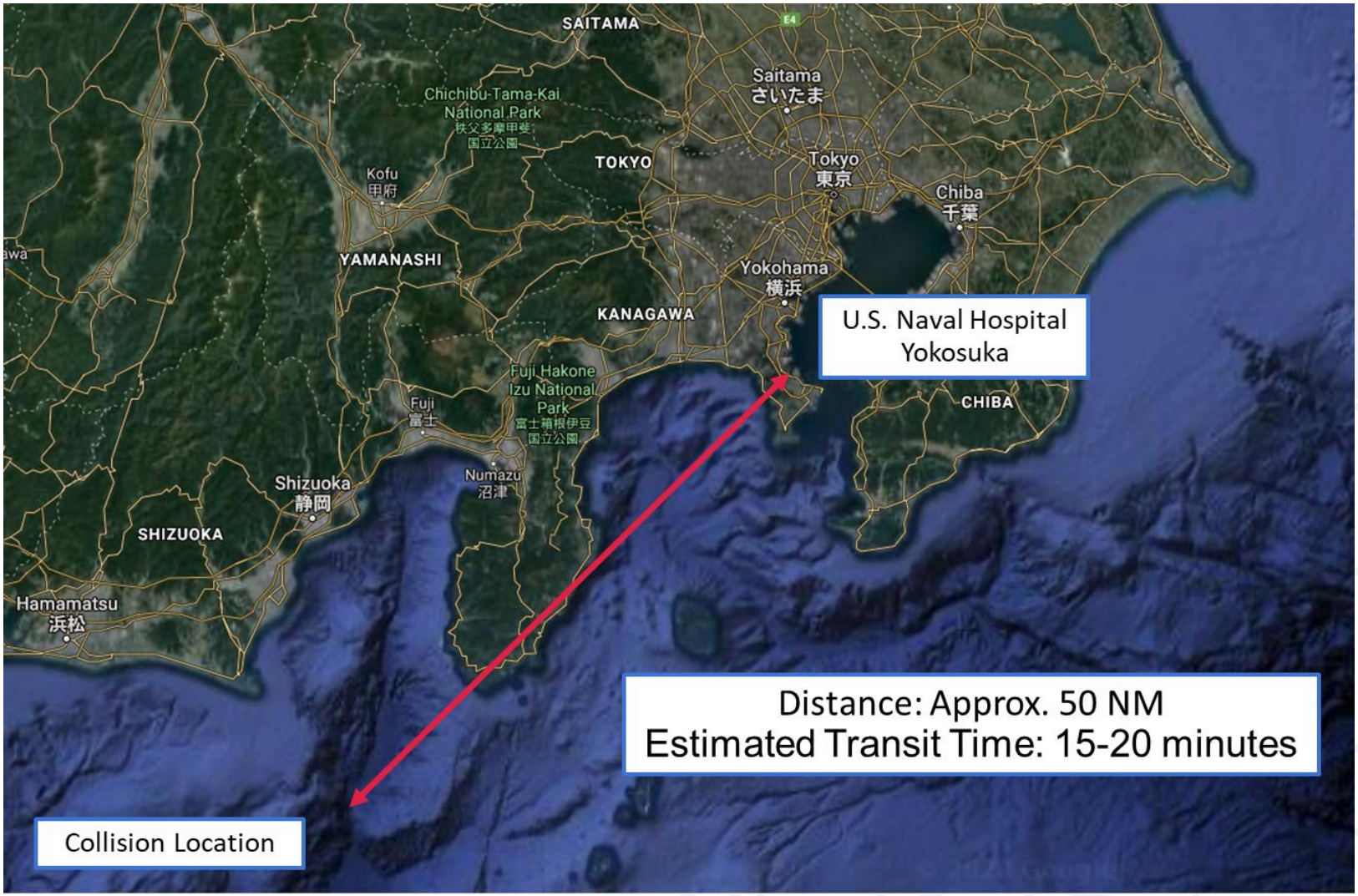
	Time (minutes)			
Distance (nm)	MV22	LCAC	LCU	AAV
10	2.5	15.0	52.2	84.5
20	5.0	30.0	104.3	169.0
30	7.5	45.0	156.5	253.5
40	10.0	60.0	208.7	338.0
50	12.5	75.0	260.9	422.5


Thailand
Bangkok
กรุงเทพมหานคร
Vietnam
Cambodia
South
China Sea
Luzon
Philippines
Panay
Negros
Mindanao
Palawan
Basilan Island
Andaman Sea
Gulf of
Thailand
Ho Chi
Minh City
Malaysia
Kuala Lumpur
Singapore
Celebes Sea
Indonesia
Jakarta
Java Sea

McCain/ALNIC Collision



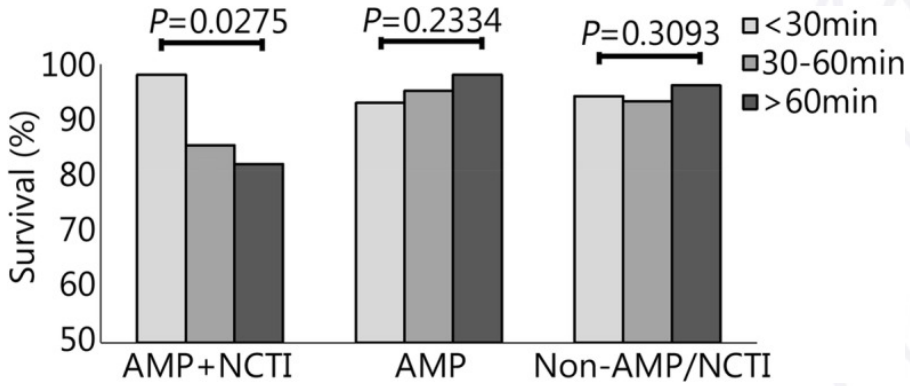
Fitzgerald/CRYSTAL Collision



Impact of MEDEVAC Transport time on combat mortality rates

2018 NIH study published in Military Medical Research Journal

- **The 'Golden Hour' is often used in trauma to suggest that an injured patient has 60 minutes from TOI to receive definitive care, after which morbidity and mortality significantly increase**
- NCTH most common cause of potentially survivable death in both military and civilian trauma
- In study: mortality rate of 16.7% for AMP+NCTI over 60 min
- "Lengthy transport times may still impact patients without NCTI in resource-limited areas of operation, such as the Pacific Ocean
- Evacuation times of patients of patients with NCTI should remain under 30 minutes. In those circumstances where transport of NCTI patients from the POI to a Role 2/3 facility is not possible...**advanced en route care capabilities and/or resources for the control of NCTI may decrease mortality**
- "Use of ultrasound by prehospital medics and non-clinical service members with minimal training" may reduce mortality rates



- AMP Amputation
- NCTI Non-compressible torso injury
- NCTH Non-compressible torso hemorrhage
- MTF Medical treatment facility
- POI Point of injury

Problem Space

- The timeline for medical assistance will increase while executing EABO in the Indo-Pacific AOR
- The requirement for inside forces to maintain mobility and minimize their signatures prevents established medical facilities
- We cannot assume persistent air superiority or sea control necessary to move patients to higher echelons of care within the "Golden Hour"
- Decreased CASEVAC aircraft availability due to increased aviation operations
  - Scheduled and unscheduled maintenance/inspection NRBA increase
  - Potential ratio of casualties: CASEVAC availability
- More important than achieving the "Golden Hour" is ensuring casualties are treated correctly and stabilized as soon as possible

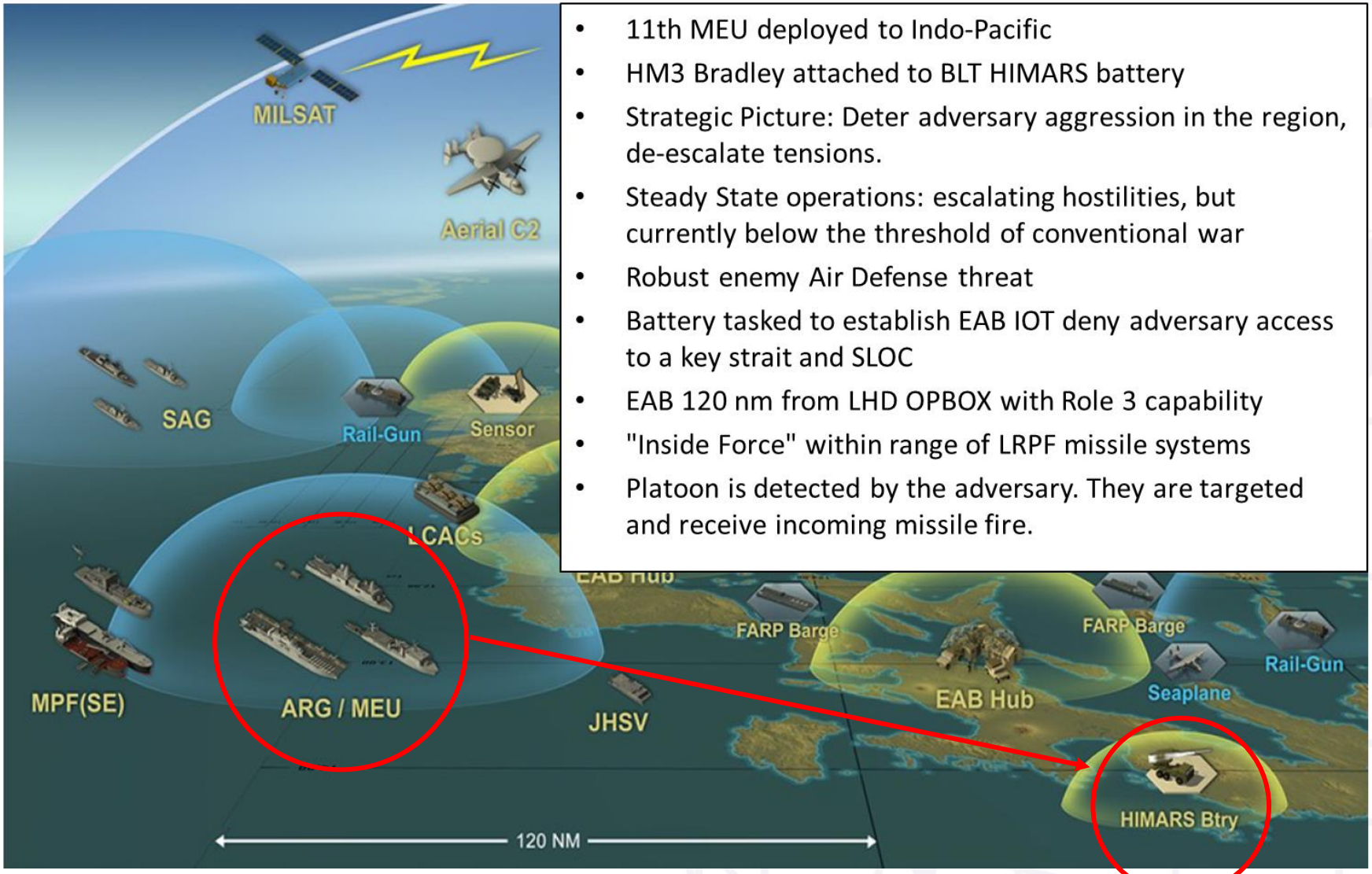
Use Case Scenario: Battle of Fallujah

- First Battalion, Eighth Marine Regiment, 2004-2005
- Aerial CASEVAC unavailable due to enemy situation within the city
- Battalion Surgeon created the "Forward Aid Station" after observing the benefits of immediate care
  - Dropping the expected 30-40% casualty rate to approximately 18%

Persona: HM3 Bradley

- **Name:** HM3 Bradley
- **Job:** Platoon corpsman
- **Demographics:** 20 yo, High School Graduate, Gen Z comfortable with technology but not necessarily knowledgeable about how it works
- **Education:** High school, Boot Camp, Hospital Corps School, Field Medical Service School, FMF pin
- **No previous deployments**
- **Only medical personnel at EAB**

Use Case Scenario Situation



- 11th MEU deployed to Indo-Pacific
- HM3 Bradley attached to BLT HIMARS battery
- Strategic Picture: Deter adversary aggression in the region, de-escalate tensions.
- Steady State operations: escalating hostilities, but currently below the threshold of conventional war
- Robust enemy Air Defense threat
- Battery tasked to establish EAB IOT deny adversary access to a key strait and SLOC
- EAB 120 nm from LHD OPBOX with Role 3 capability
- "Inside Force" within range of LRPF missile systems
- Platoon is detected by the adversary. They are targeted and receive incoming missile fire.

Use Case (Present)

Time

0-5

Platoon takes casualty

HM3 Bradley assesses casualty

Begins CLS/TCCC

Reports 9-line information to Platoon HQ

10-30

Continues providing limited care

AD Threat/No escorts available

9-line reported to CoC

30-45

CASEVAC lands at EAB

Escorts available/CASEVAC launched

45-60

60-90

Patient arrives at Role 3 for treatment

Use Case (Future)

Time

0-5

Platoon takes casualty

HM3 Bradley assesses casualty assisted by ECHOS

9-line automatically fills

10-30

Determines enhanced care needed

CoC/Casevac updated in real time

30-45

Telementor FAST exam using ultrasound/FMV

Connects with Role 3 facility

45-60

Diagnose NCTI

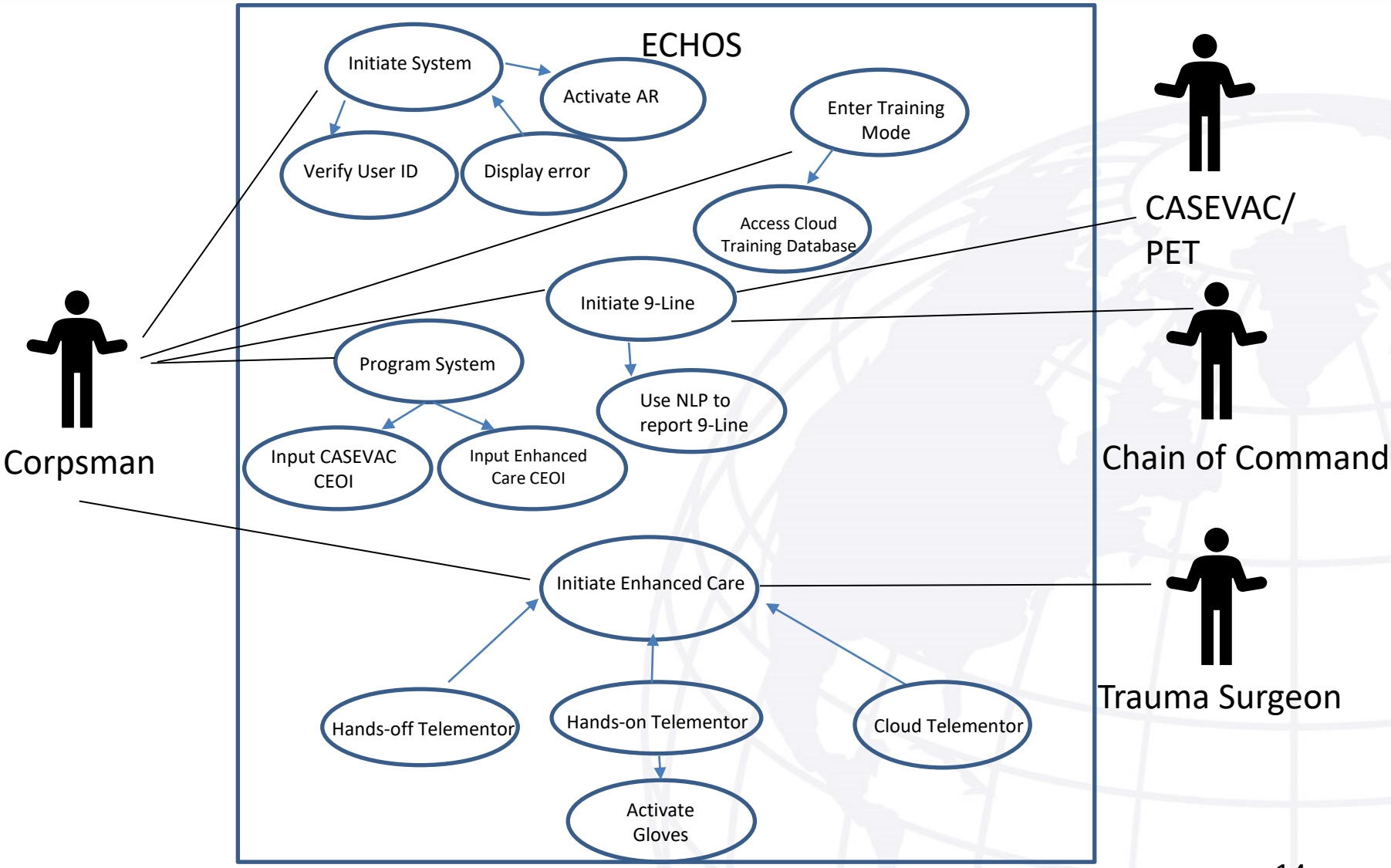
Telementor advanced procedure

60-90

Seamless CASEVAC handoff

Patient arrives at Role 3 for treatment

Use Case Diagram



Proposed Phased Roll Out

- Phase 1: Training
  - ECHOS is implemented both in the corpsmen training pipeline as well as an added training capability while forward deployed or in the field.
  - 5G is limited to local positions allowing virtual training, but limited connectivity to higher echelons of care.
- Phase 2: Digital 9-Line Hand Off
  - ECHOS allows for an enhanced and streamlined 9-line procedure.
  - Voice enable receiver captures 9-line requirements and stores medical data that can be passed off when CASEVAC platform arrives.
  - Limited latency and bandwidth capability, data is passed from 5G nodes from local position to CASEVAC platform.
    - Phase 2a: 9-Line message is integrated with current communication structure sending an updated concurrent message via chat to a higher command post.
    - Phase 2b: 9-Line message is integrated with future 5G enabled COP, concurrently updating the chain of command throughout the CASEVAC process.
- Phase 3: Telementoring
  - ECHOS is used to communicate between corpsmen and physician.
  - Established 5G network allows for quick data transfer and communication between corpsmen and high echelon of care.
- Phase 4: Telesurgery
  - ECHOS can be enabled to allow a physician to conduct aided surgery from a distant location.

Impacts to DOTMLPF

Category	Negligible	Low	Medium	High
Doctrine				
Organization				
Training				
Materiel				
Leadership				
Personnel				
Facilities				

Doctrine

-No change

-Build on GWOT lessons learned ("Golden Hour")

Organization

-No change

-Augment existing organization

-Emphasis on speed within current structure

Training

-Connectivity is essential to employment
  -deconfliction communication channels
  -service cross-compatibility

-Communications link critical

-Schoolhouse and fleet training

-OGA/civilian cross-training (TTP's)

Materiel

-Existing supply chain
- allocation (accounting for inspection cycle NRFI timeline)

-Product manufacture location (CPU, transmit/receive)

-Replacements and higher echelon maintenance (minimal user level)
- Replacement components at multiple sites
- Test benches/tool allocation at multiple sites
- Maximize Operational/Intermediate level maintenance capabilities

Leadership

-Early exposure in training pipelines

-SNCO and Officer

-IDC requirement

-Effective corpsman/CoC coordination

Personnel

-Field with existing personnel

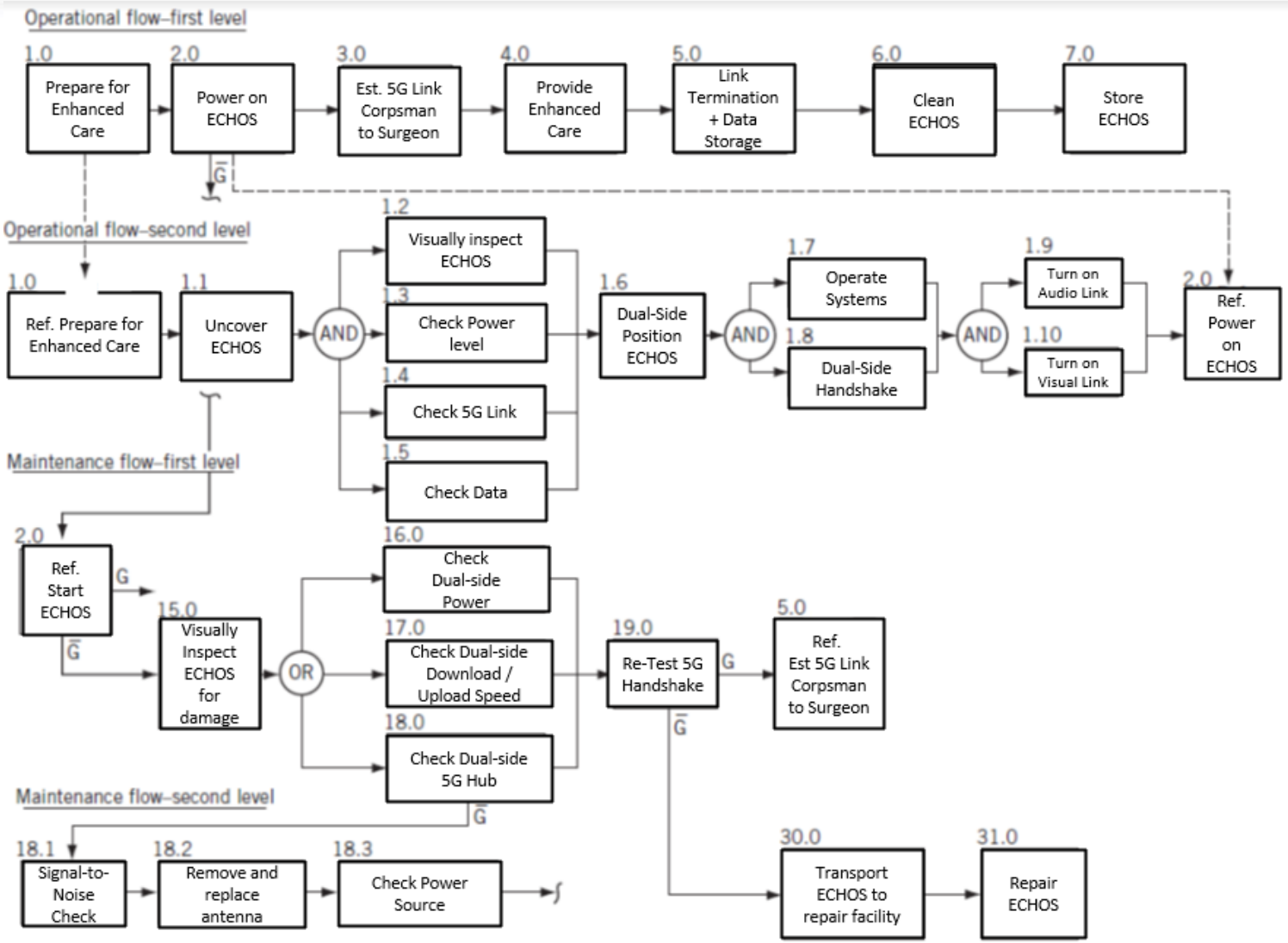
-No additional personnel required

Facilities

-No additional facilities required

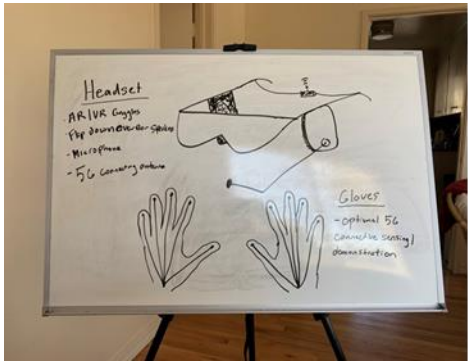
-Will require warehouse space for initial fielding and Class IX

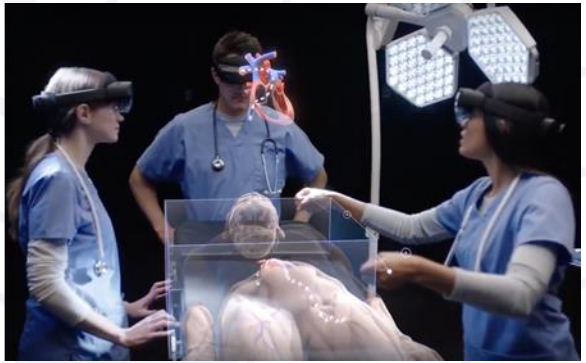
FFD


Operational flow–first level
1.0
Prepare for Enhanced Care
2.0
Power on ECHOS
3.0
Est. 5G Link Corpsman to Surgeon
4.0
Provide Enhanced Care
5.0
Link Termination + Data Storage
6.0
Clean ECHOS
7.0
Store ECHOS
G
Operational flow–second level
1.0
Ref. Prepare for Enhanced Care
1.1
Uncover ECHOS
AND
1.2
Visually inspect ECHOS
1.3
Check Power level
1.4
Check 5G Link
1.5
Check Data
1.6
Dual-Side Position ECHOS
AND
1.7
Operate Systems
1.8
Dual-Side Handshake
AND
1.9
Turn on Audio Link
1.10
Turn on Visual Link
2.0
Ref. Power on ECHOS
Maintenance flow–first level
2.0
Ref. Start ECHOS
G
15.0
Visually Inspect ECHOS for damage
OR
16.0
Check Dual-side Power
17.0
Check Dual-side Download / Upload Speed
18.0
Check Dual-side 5G Hub
19.0
Re-Test 5G Handshake
G
5.0
Ref. Est 5G Link Corpsman to Surgeon
Maintenance flow–second level
18.1
Signal-to-Noise Check
18.2
Remove and replace antenna
18.3
Check Power Source
30.0
Transport ECHOS to repair facility
31.0
Repair ECHOS

Recommended Design

- Corpsman
  - Gloves, Goggles, Earpiece (5G compatible)
    - Automatic language recognition protocol (for Nine Line)
    - NVG capability
    - Field battery/power source rechargeability
    - Error code retention for later download/system maintenance
    - Extreme temp/environmental survivability
    - Compatibility with all MOPP levels
    - Sanitation considerations for re-use (in field)
- Hospital/BAS/Ship ER (5G compatible)
    - Goggles (surgeon)
    - Gloves (for optional hands on tele-mentoring)
    - Audio connectivity
    - Receipt of Nine Line and medical staff procedure/equipment preparation (file saved for medical record adaptability)





How it works

An ultrasound scan is performed by a paramedic wearing a special glove to guide his hand as he moves the ultrasound probe

1

Paramedic

Haptic glove

2 Scan data is sent over the 5G network from the ambulance to the hospital

3 Doctors or surgeons viewing in real-time use a joystick to send instructions to the paramedic's hand to obtain the clearest images

https://www.thetimes.co.uk/article/robo-glove-lets-clinicians-treat-ambulance-patients-over-internet-27ds9vqtx

How it works: U.S. Army

- Wearable augmented reality (AR) telestration device to guide a non-surgeon through a damage control procedure

- 19 February 2020