

Command and Control for Human Spaceflight Support Medical Operations

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Disclosure Information

93rd Annual Scientific Meeting

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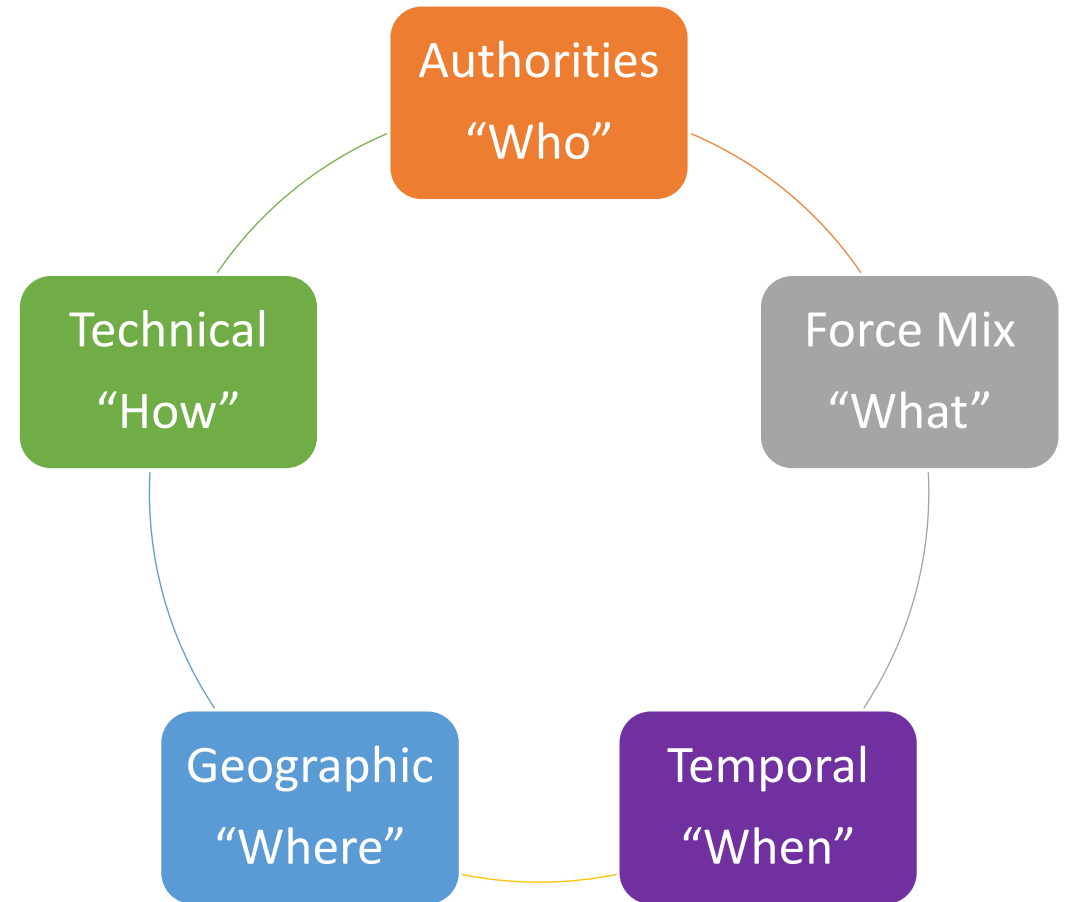
I am employed by NASA and USAF Reserves

Commercial Crew Program Medical Officer, NASA-JSC
IMA to Chief of Bioastronautics, 1AF DET3, Patrick SFB, FL

I will not discuss off-label use and/or investigational use in my presentation

Command and Control

The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Also called C2. (JP 1)



Source: Congressional Research Service

Mission Support Team

Mission management responsibility has been delegated by NASA CCP to the commercial providers

SpaceX chairs the Dragon Mission Management Team (DMMT) for crewed Dragon missions

NASA is a voting member of the DMMT and has veto authority for decisions that could incur increased risk to the crews of those flights and/or ISS

During key operations, NASA may be called upon for rapid assessment/acceptance of the risk associated with a condition or operation outside the certified baseline for the commercial provider's systems and processes. To support this function, NASA stands up a Mission Support Team (MST), led by NASA CCP management and staffed with key subject matter experts, to provide risk assessments and recommendations as needed.

NASA Chief Medical Officer (CMO) is a polling member

SpaceX Personnel

DMMT Chair

Dragon Mission Director

SpaceX Mission Manager

Dragon Flight Reliability

NASA Personnel

Operations Manager

Chief Engineer

Chief Safety Officer

Chief Medical Officer

Flight Operations Directorate Representative

ISS Program Representative

Launch Rescue Director



Mission Control Center History

NASA's first flight director Christopher C. Kraft developed the concept of a mission control center to monitor human spaceflights

First control center was at Cape Kennedy Air Force Station (now Cape Canaveral Space Force Station) and monitored Mercury and early Gemini missions

MCC Houston took over primary flight control for human space missions April 9, 1965

Gemini IV marks (America's first spacewalk) marks 1st mission from MCC-H as primary

He personally invented the mission planning and control processes required for crewed space missions, in areas as diverse as go/no-go decisions, space-to-ground communications, space tracking, real-time problem solving and crew recovery

SURGEON Roles and Responsibility

Medical representative to the control team

Direct all medical activities during the mission

Monitor environmental control and life support systems via telemetry for physiological impacts

Provide crew consultation

Advise control center director on medical risks and impacts

Voice Loops



PRIMARY OPERATIONS COORDINATION LOOP

Communication of mission-essential items during operations to Control Team Director



SPACE TO GROUND LOOP

Communication loops between astronaut and ground control teams during free flight – can be privatized for medical discussions



NON-PRIVATE MEDICAL COORDINATION LOOP

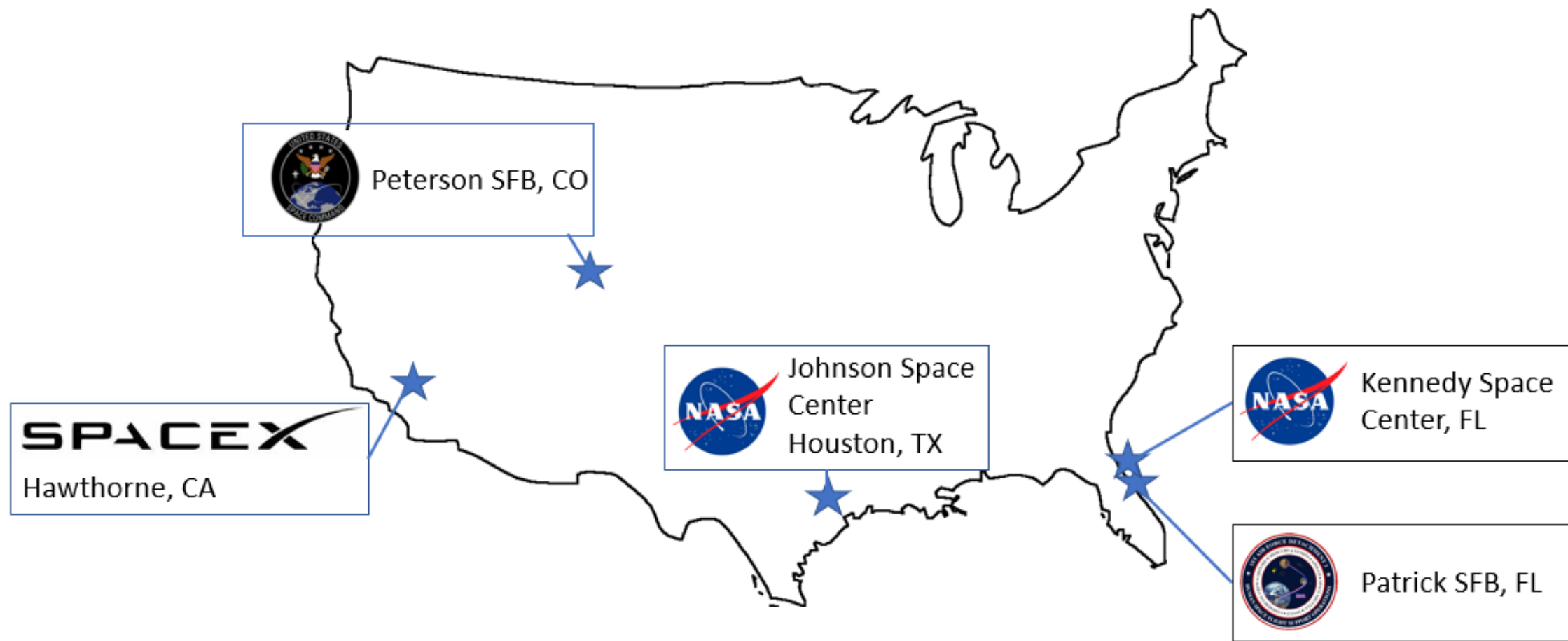
Coordination loop between Flight Control team and Surgeon



PRIVATE MEDICAL COORDINATION LOOP

Restricted to medical personnel for private medical discussions and coordination

Control Center Medical Support



A wide-angle photograph of the SpaceX Mission Control Center (MCC-X) in Hawthorne, CA. The room is a large, modern space with a high ceiling and a curved wall of floor-to-ceiling windows. In the foreground, several rows of white console desks are arranged, each equipped with multiple computer monitors. A few people are visible at the consoles. In the background, a large crowd of people is gathered, and a large, dark, conical object, likely a spacecraft component, is suspended from the ceiling. The lighting is bright, and the overall atmosphere is one of a high-tech, professional environment.

SpaceX Mission Control Center Hawthorne, CA MCC-X

NASA Flight Surgeon – call sign
“Hawthorne Surgeon”

Integrated operator with SpaceX Flight
Control Team

Provide free-flight medical support for
NASA crewed missions

Trained and certified by SpaceX on
Dragon systems, suit systems, crew
protocols, free-flight risks and
responses, and console tools

24/7 coverage during free-flight
operations



NASA Mission Control Center Houston, TX MCC-H

NASA Flight Surgeon - call sign "ISS Surgeon"

Provide medical support for ISS operations

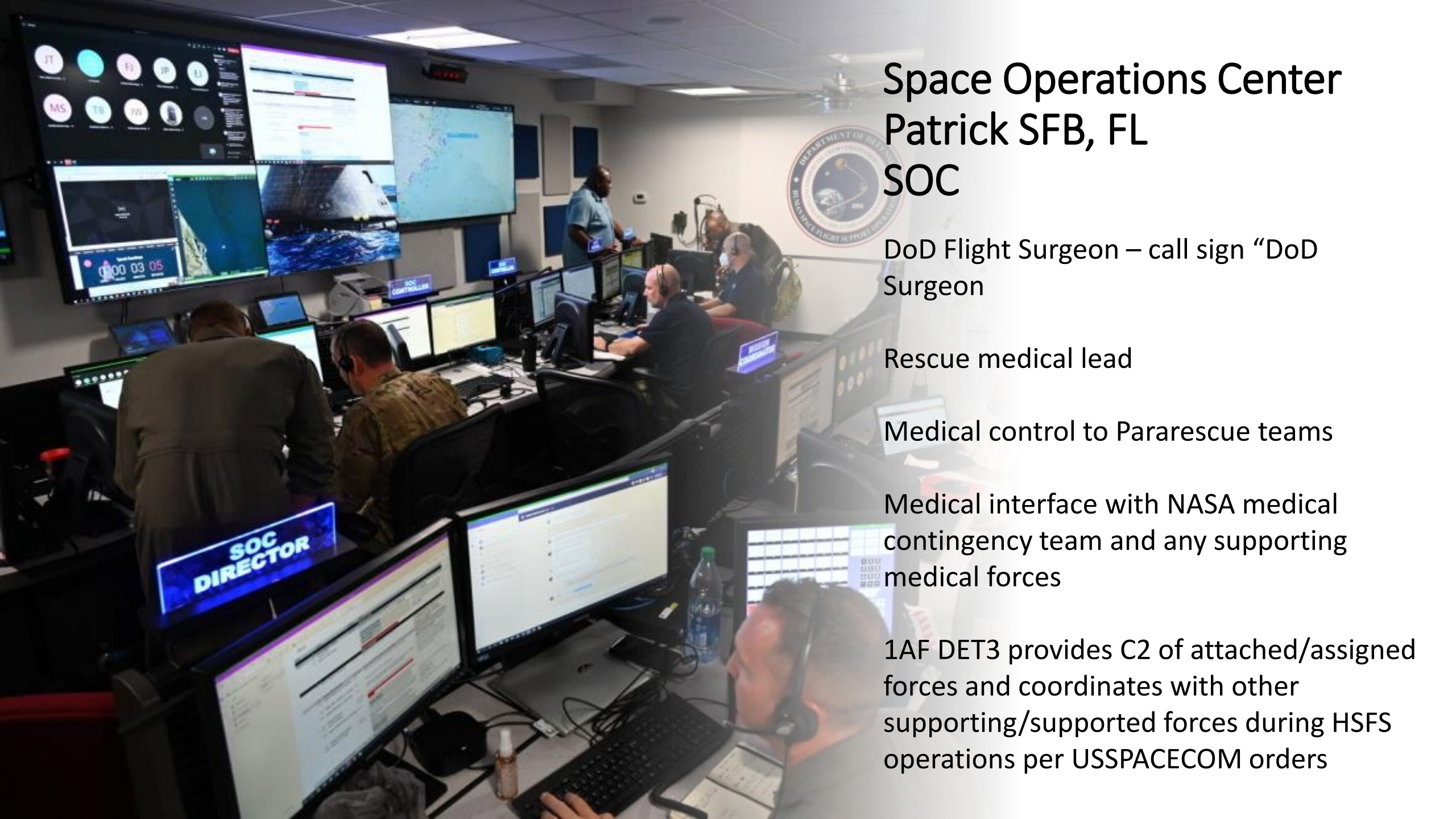
Specialized operators provide contingency support from alternate control room locations

Increment Management Center

Staffed by medical contingency experts during launch and landing operations

Receive and disseminate information

Coordinate with rescue personnel and Definitive Medical Care Facilities (DMCF) when contingency declared



Space Operations Center Patrick SFB, FL SOC

DoD Flight Surgeon – call sign “DoD Surgeon

Rescue medical lead

Medical control to Pararescue teams

Medical interface with NASA medical contingency team and any supporting medical forces

1AF DET3 provides C2 of attached/assigned forces and coordinates with other supporting/supported forces during HSFS operations per USSPACECOM orders



Emergency Operations Center Kennedy Space Center, FL EOC

Staffed during launch operations

Access to launch communications, video, and communications with local county and state EOC's

NASA Launch Rescue Director (LRD) coordinates readiness and deployment of KSC medical and DoD rescue assets on launch day and initiates NASA response in pad emergency egress and pad abort scenarios

EMS coordinator leads EMS and MEDEVAC response as required

Chief Medical Officer coordinates medical communication

The LRD and CMO participate in NASA Mission Management polls for launch



Joint Operations Center Peterson SFB, CO JOC

Delivers space and counter space situational awareness, command and control and logistical support for the Department of Defense

Medically staffed during HSFS operations by Command Surgeon and/or delegate

Medical interface to USSPACECOM leadership

Comm Assets



RADIO



VOICE LOOPS



PHONE



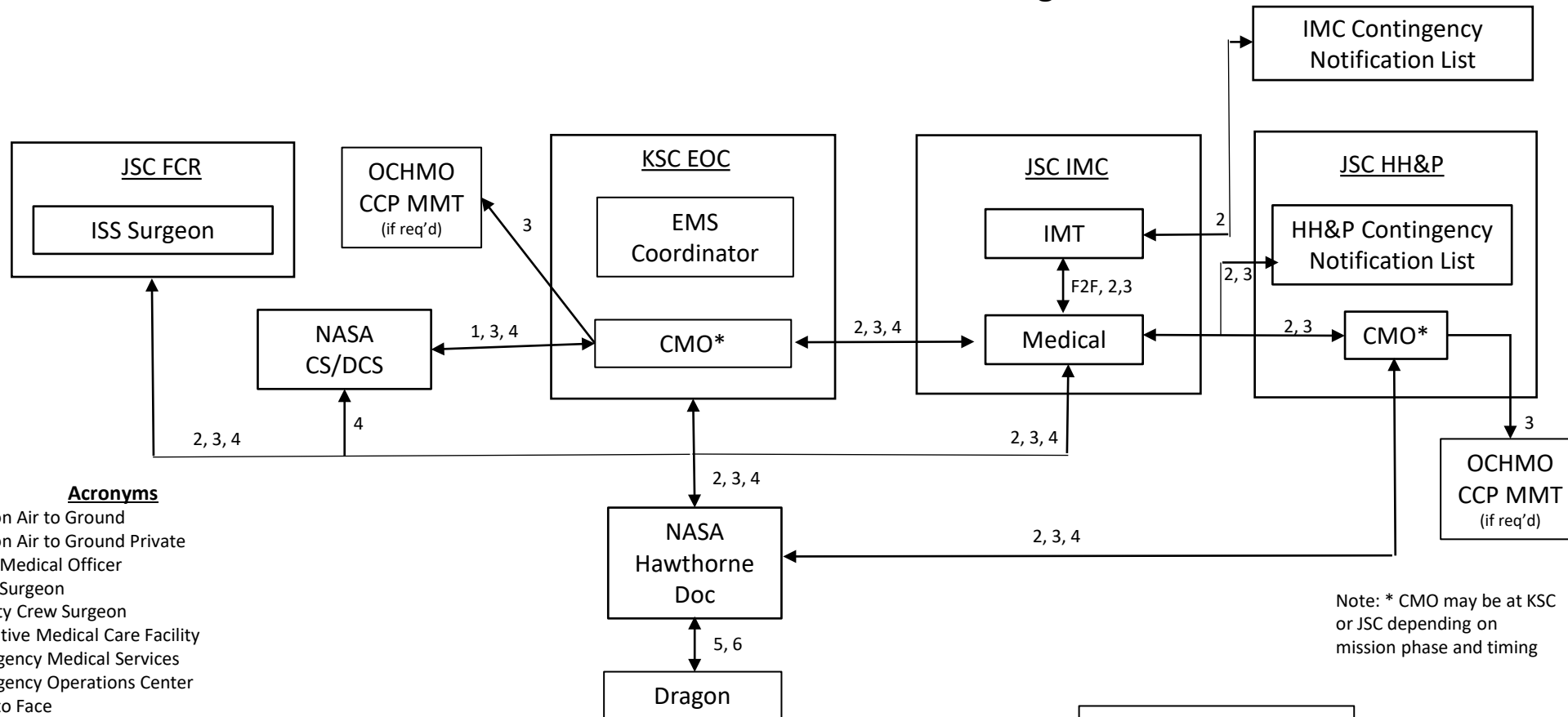
EMAIL



MESSAGING

SpaceX Nominal Medical Communication Paths

Dragon Hatch Closure through ISS Hatch Open
Hawthorne Controlling



Acronyms

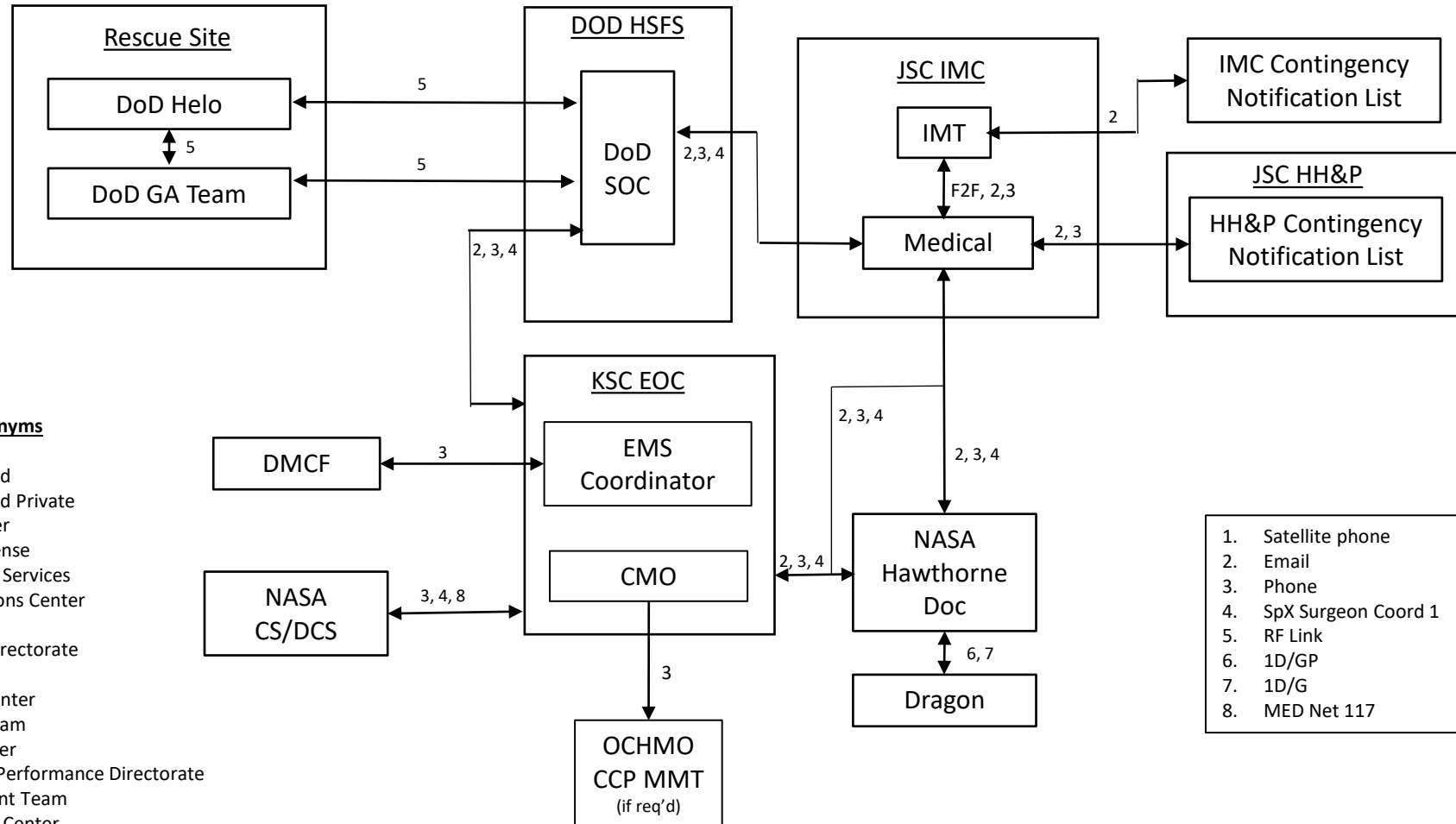
1D/G	Dragon Air to Ground
1D/GP	Dragon Air to Ground Private
CMO	Chief Medical Officer
CS	Crew Surgeon
DCS	Deputy Crew Surgeon
DMCF	Definitive Medical Care Facility
EMS	Emergency Medical Services
EOC	Emergency Operations Center
F2F	Face to Face
FCR	Flight Control Room
HH&P	Human Health and Performance Directorate
IMT	Increment Management Team
IMC	ISS Management Center
ISS	International Space Station
JSC	Johnson Space Center
KSC	Kennedy Space Center
MMT	Mission Management Team
TDRS	Tracking and Data Relay Satellite

Note: * CMO may be at KSC or JSC depending on mission phase and timing

1. KSC MED NET 117
2. Email
3. Phone
4. Voice Loops
5. 1D/GP
6. 1D/G

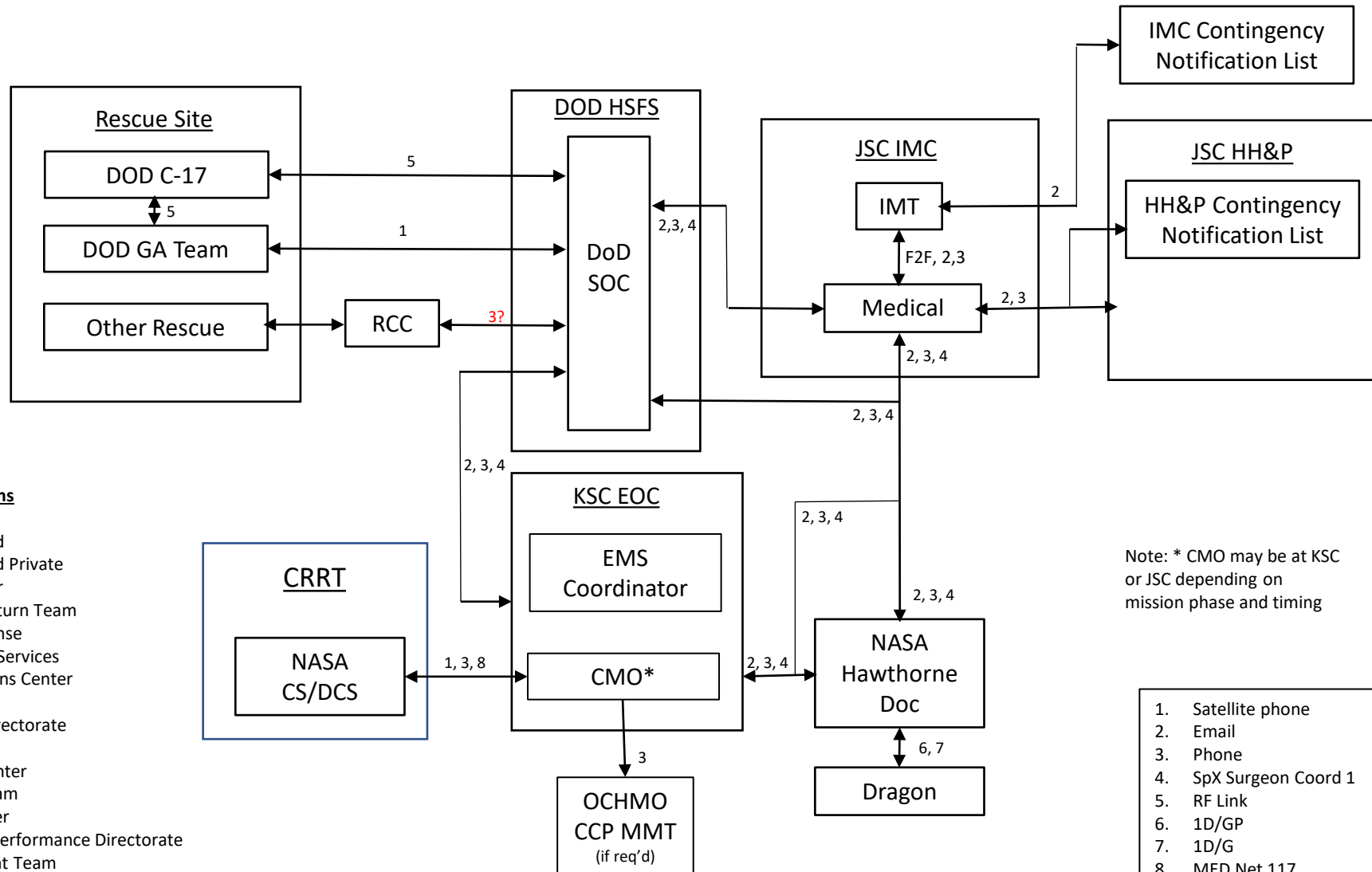
SpaceX Launch Rescue Communication Paths

SpaceX Pad Abort (Dragon in water KSC)

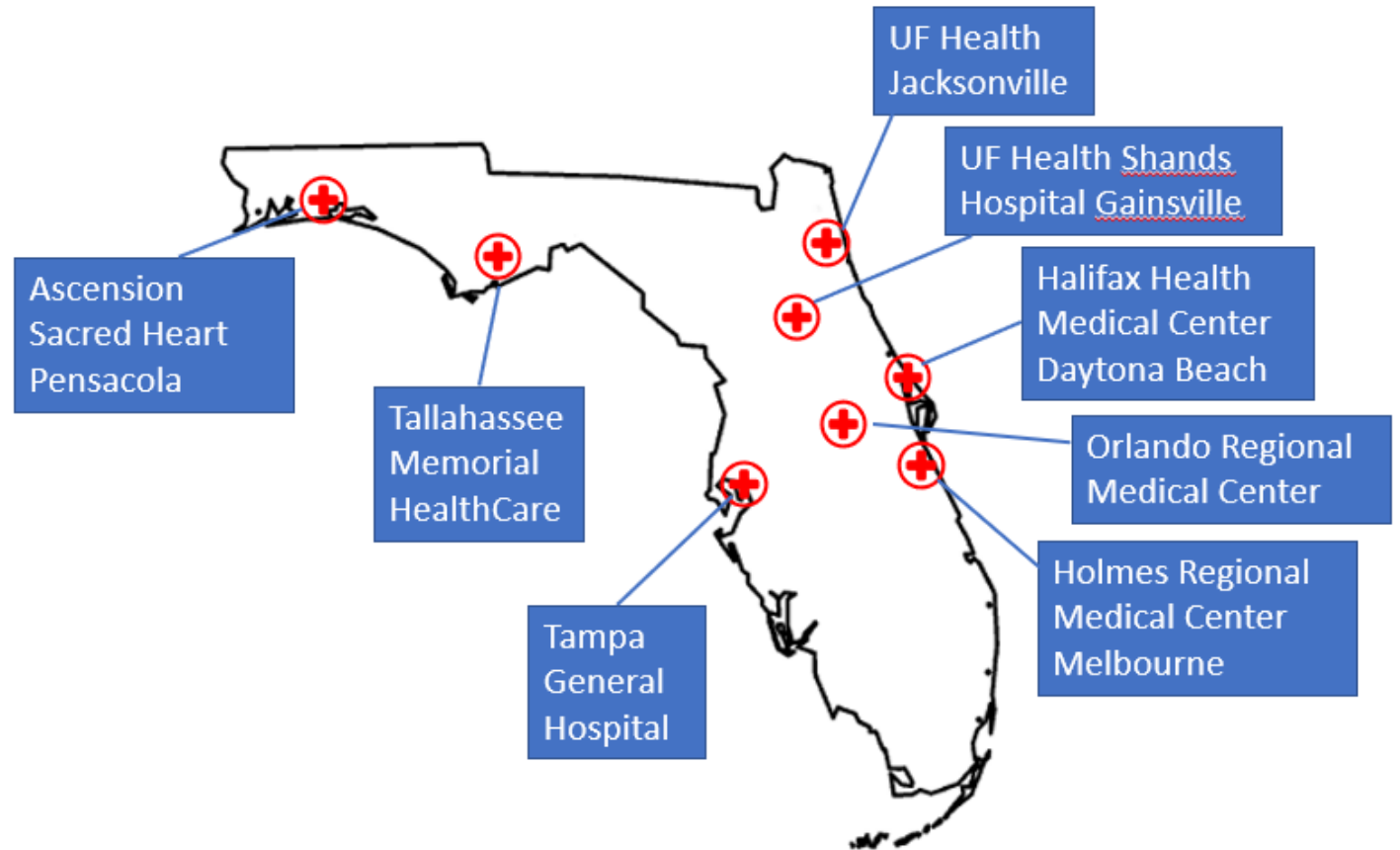


SpaceX Launch Rescue Communication Paths

Downrange Ascent Abort (East Coast Abort)



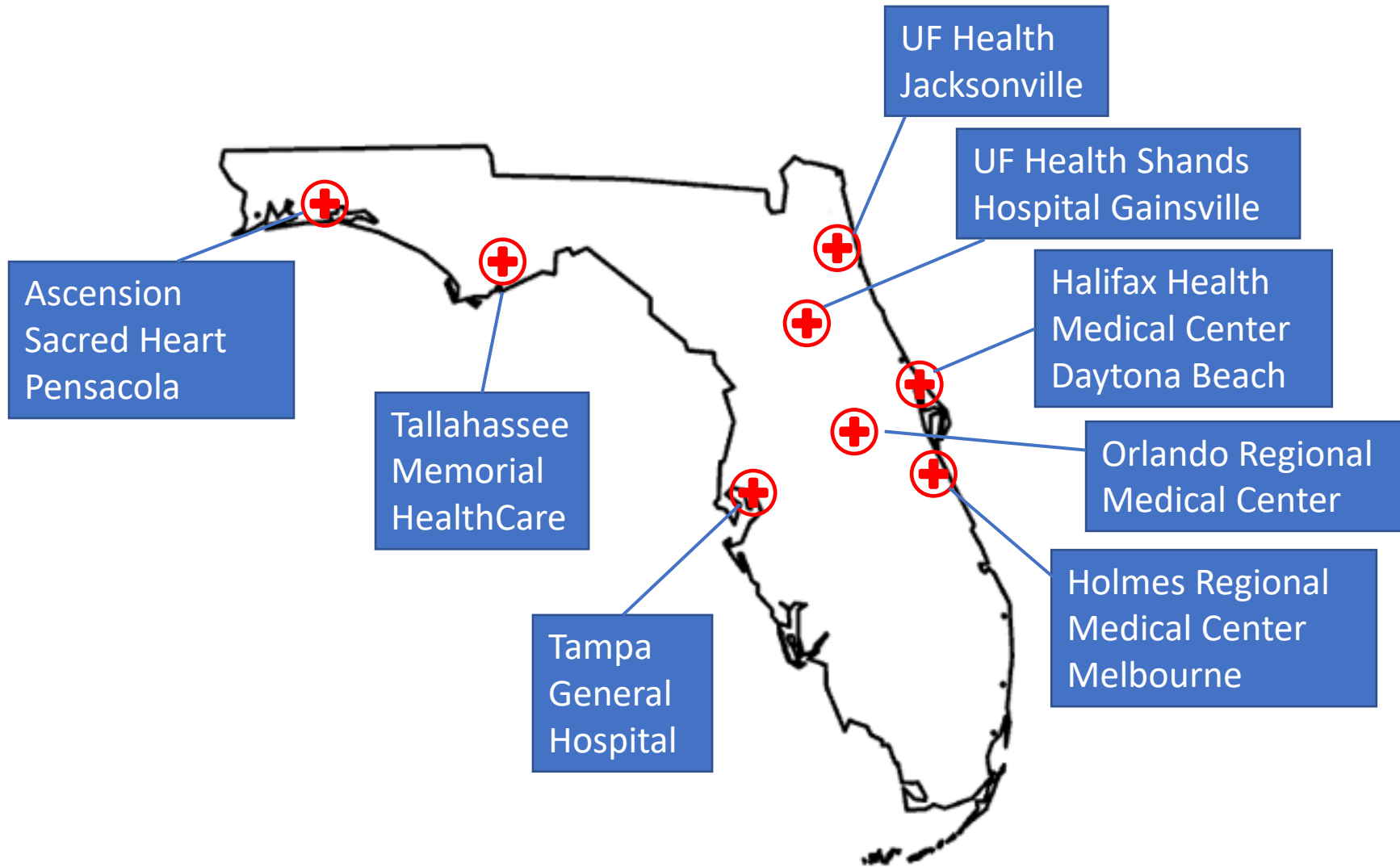
Definitive Medical Care Facilities





Questions

Backup



Medical Support

