EIS Then and Now
Tracking the Human-Suit Interface

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The Problem

- Over the years we have identified several significant injuries

  - Shoulder injuries (Slap, rotator cuff)

  - Knee injuries (meniscal tears)
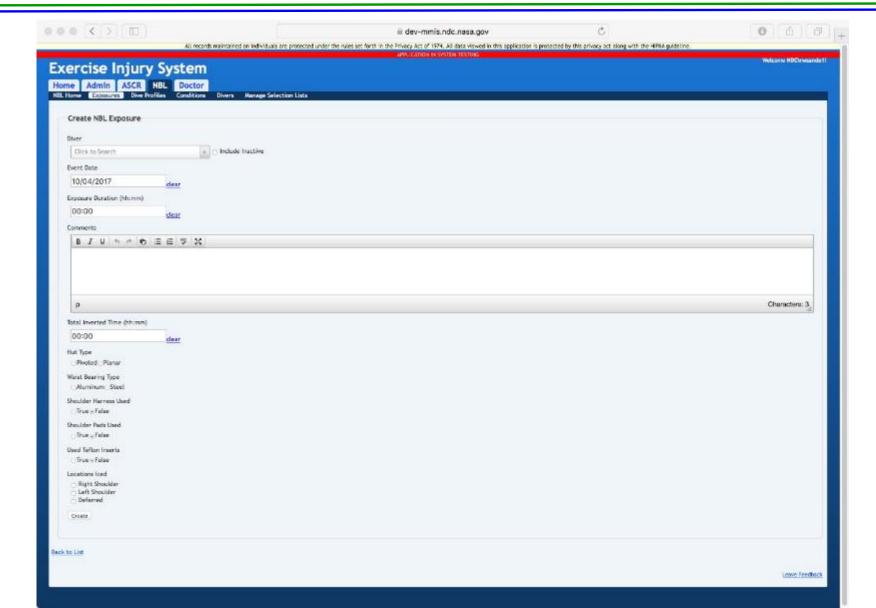
  - Fingernail Delamination

  - What else?

Document to Prevent

- EIS
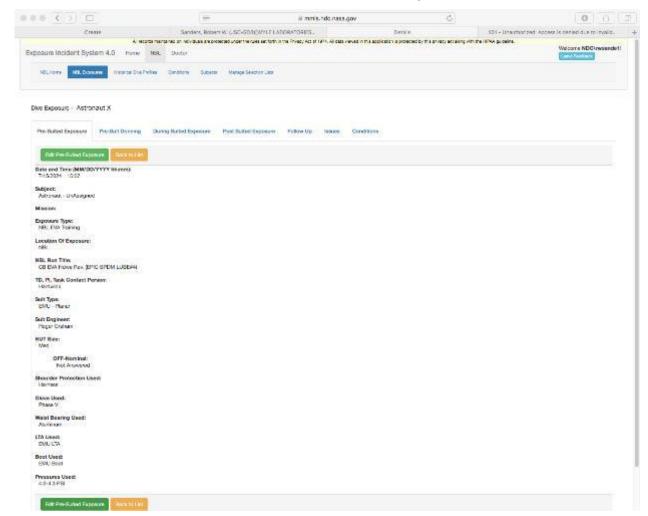
Sometimes We Fail

EIS

- We have learned a lot
  - Shoulder injury prevention
  - ASCR Conditioning
  - Inverted Ops
  - Minimize repeated failed attempts

  - But learned from injury
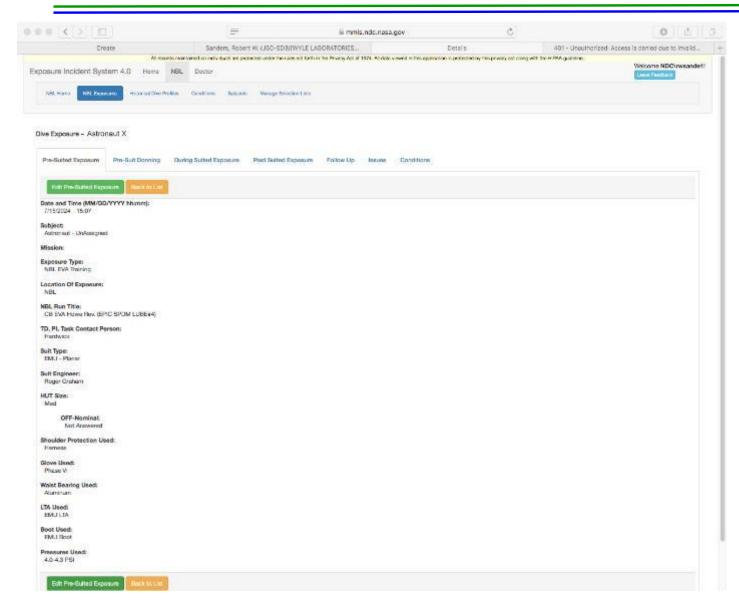 - Attributed to the suit

EIS 2.0

- Desire to learn more about the "pre-exposure" subject (vs. suit)
  - Prone to injury?

  - Sleep?

  - Hydration?

  - Activity level and type
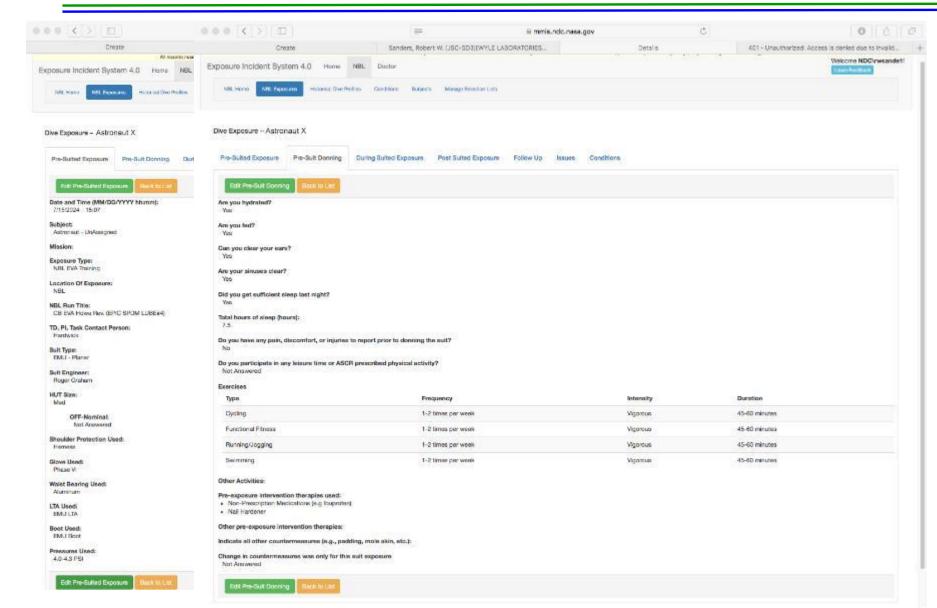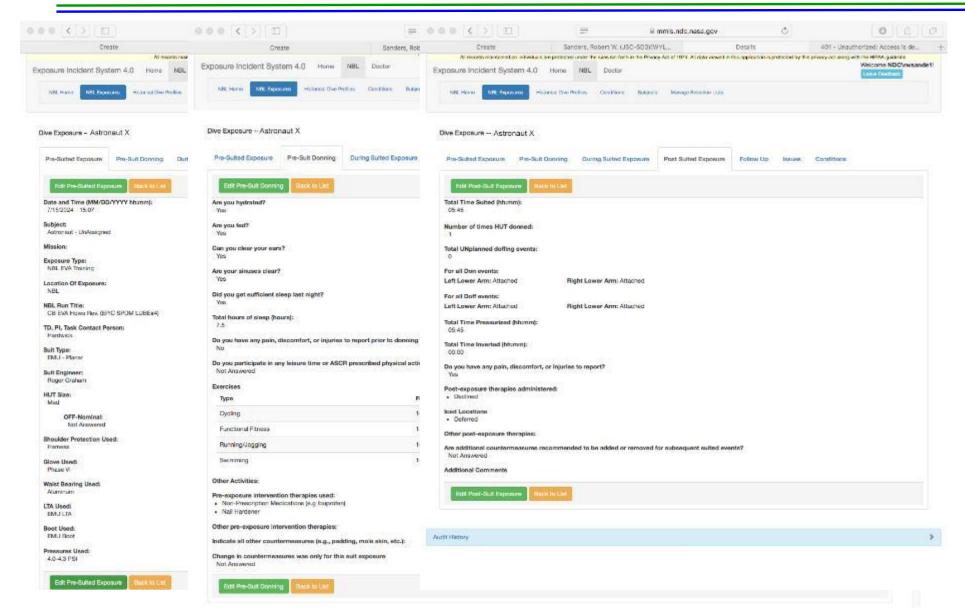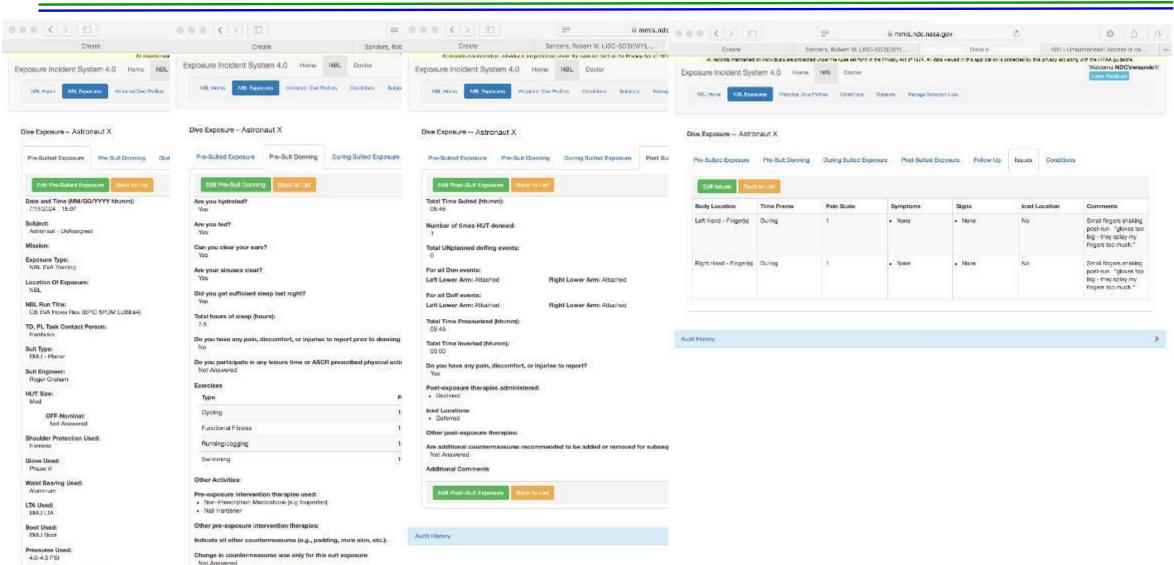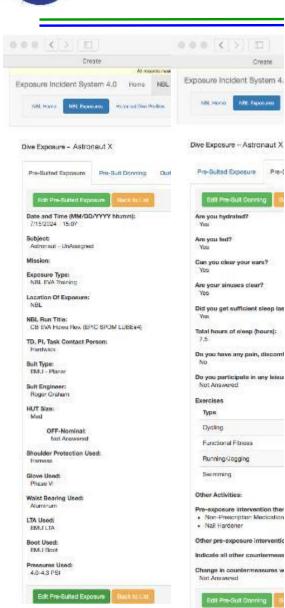
    - Are they ready/fit?

  - Preexisting injury?

EIS 2.0

EIS 2.0

EIS 2.0

EIS 2.0

Welcome **NDC\rwsande1!**

Exposure Incident System 4.0   Home   NBL   Doctor

NBL Home   NBL Exposures   Historical Dive Profiles   Conditions   Subjects   Manage Selection Lists

Common Activities

Create Dive Exposure   **Create 1G Exposure**

Recent NBL Exposures

	Full Name	Exposure Date	Event Description	Lab	Location of Exposure	Suit Used	LTA Used	Conditions	Actions
Details			1G - NBLWet	NBL EVA/ISS Procedure Development	NBL	EMU - Planar	EMU LTA	0	Add Condition
Details			1G - NBLWet	NBL EVA/ISS Procedure Development	NBL	EMU - Planar	EMU LTA	0	Add Condition
Details			1G -	Mission Training		EMU - Planar	EMU LTA	0	Add Condition
Details			1G - NBLWet	NBL EVA Training	NBL	EMU - Planar	EMU LTA	0	Add Condition
Details			1G - NBLWet	NBL EVA Training	NBL	EMU - Planar	EMU LTA	0	Add Condition
Details			1G - NBLWet	NBL EVA Training	NBL	EMU - Planar	EMU LTA	0	Add Condition
Details			1G - NBLWet	NBL EVA Training	NBL	EMU - Planar	EMU LTA	0	Add Condition
Details			1G - NBLWet	NBL EVA Training	NBL	EMU - Planar	EMU LTA	0	Add Condition
Details			1G - NBLWet	NBL EVA Training	NBL	EMU - Planar	EMU LTA	0	Add Condition
Details			1G - NBLWet	NBL EVA Training	NBL	Z-2	EMU LTA	0	Add Condition

Latest NBL Exposures Resulting in a Condition Report

		Subject	Date	Event Description	Condition
Exposure	Condition			1G - NBLWet	Bilateral thumb pain 2/2 glove fit issues and "break points" got to point where CM preferred to truncate run, and requested pain meds
Exposure	Condition			1G - NBLWet	Subconjunctival Hematoma noted after run possibly due to inverted time
Exposure	Condition			1G - NBLWet	after the run, the patient complains of pain over her left shoulder, espe cially in the deltoid region. Patient states throughout the run. She felt

Dive Exposure – Astronaut X

Pre-Suited Exposure   Pre-Suit Donning   Dur

Edit Pre-Suited Exposure   **Back to List**

Date and Time (MM/DD/YYYY hh:mm):
7/15/2024   15:07

Subject:
Astronaut – UnAssigned

Mission:

Exposure Type:
NBL EVA Training

Location Of Exposure:
NBL

NBL Run Title:
CB EVA Home Rev. (BPC SPDM LUBE#4)

TD, PI, Task Contact Person:
Hardwick

Suit Type:
EMU - Planar

Suit Engineer:
Roger Graham

HUT Size:
Med

   OFF-Nominal:
   Not Answered

Shoulder Protection Used:
Harness

Glove Used:
Phase VI

Waist Bearing Used:
Aluminum

LTA Used:
EMU LTA

Boot Used:
EMU Boot

Pressures Used:
4.0-4.3 PSI

Edit Pre-Suited Exposure   **Back to List**

Dive Exposure – Astronaut X

Pre-Suited Exposure   Pre-C

Edit Pre-Suit Donning   B

Are you hydrated?
Yes

Are you fed?
Yes

Can you clear your ears?
Yes

Are your sinuses clear?
Yes

Did you get sufficient sleep las
Yes

Total hours of sleep (hours):
7.5

Do you have any pain, discom
No

Do you participate in any leisu
Not Answered

Exercises
  Type
  Cycling
  Functional Fitness
  Running/Jogging
  Swimming

Other Activities:

Pre-exposure intervention the
- Non-Prescription Medication
- Nail Hardener

Other pre-exposure interventio

Indicate all other countermeas

Change in countermeasures w
Not Answered

Edit Pre-Suit Donning   B

	Signs	Iced Location	Comments
	• None	No	Small fingers shaking post-run. "gloves too big - they splay my fingers too much."
	• None	No	Small fingers shaking post-run. "gloves too big - they splay my fingers too much."

Still just learning from mistakes...

- Modelling can *prevent* the need to learn from "misteaks"
  - Proactive
  - Prevent or Decrease injuries
  - New Suit Design – Injury ***prevention***
  - No Need to expose personnel to suit to learn

Modelling is a Solid Answer

- What we know is from EMU in NBL
  - vetted in microgravity.
    .

- No new injury patterns "discovered" in space,
  - our process is "working"

- Imagine the benefit to modeling the suit-human interface...
  - to guide suit use and astronaut training in preventive measures without ever having to injure a crew member
  - For planetary missions, there is no equivalent analog... modeling is our only option

Thank You!

- *There is no perfect suit… There is no perfect human, but with the proper modeling, we may create the ideal human-suit interface ... with virtually all injuries made a thing of the past!*

- Questions?