# Capsule Data Improvements

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## Motivation

A long-term goal for the National Ignition Facility (NIF) is how to achieve fusion ignition consistently. Physicists at Lawrence Livermore National Laboratory (LLNL) use data to predict capsule performance in upcoming shots and use experiment results to understand shot performance. Given the recent increase in ignition breakthroughs, there is now more data about capsules that reached fusion ignition successfully. This has led to an increased scrutiny over the metrology data that General Atomics (GA) collects and transfers to LLNL. Historically, after data generation the data transfers were done manually, causing a delay between data generation and data delivery. This poster discusses how GA transformed their data transfer system by automating transfers and developing a new tracking system to ensure all data reaches LLNL in a timely fashion.

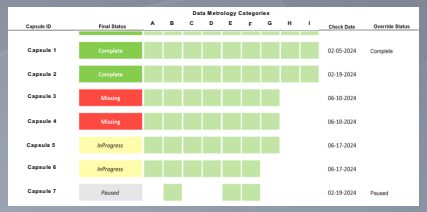
## Capsule Data Transfer Improvements

### New Data Tracker

- Tracks which data files were transferred for which capsules
- Tracks priority/schedule changes for specific capsules

### New Automated Data Gathering Scripts

- Automatically gathers and transfers data daily using cloud



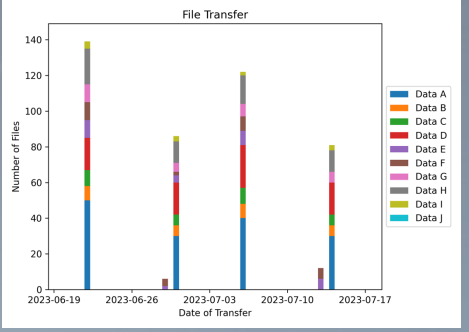

If data is available and stored correctly, there should be a **1-2 business day** turnaround.

## Key Benefits

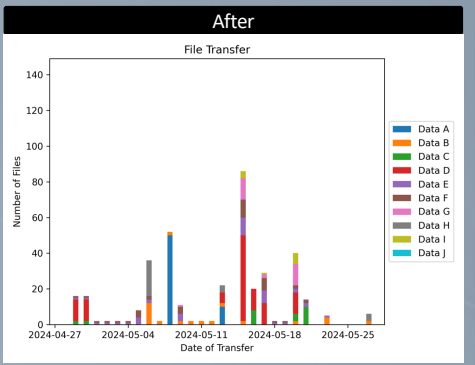
### Reduces Data Turnaround Times

- Removes transfer bottleneck by separating different metrology transfer timelines
- Allows for LLNL to make critical capsule decisions sooner

**Before**




**After**




### Increases GA Accountability and Standardizes Receipts

- Accessible data receipts that track capsule progress in data pipeline
- Alerts GA if data package is incomplete after a given due date, which prompts GA to investigate which metrology techniques are still missing and why

### Increases GA's Flexibility to Accommodate Special Requests from LLNL

- Adaptable to other production capsule types beyond high-density carbon (HDC) capsules
- Can capture special, non-standard capsule requests and their completion statuses

## Capsule Data Facts

| | |
|---|---|
| **300 GB**<br>Generated daily | **50 GB**<br>Transferred daily |
| **>100 Files**<br>Transferred weekly | That's over **1 TB** of data transferred to LLNL each month for capsules alone! |

** Not all acquired data is required to be transferred

### What are some types of data are we gathering?

| Wall Uniformity | Surface Defects | Capsule Shape | Drill Hole Analysis | Tomography Analysis |
|---|---|---|---|---|

## Capsule Data Key Challenges

### Delayed Data Turnaround Times

- Each week, GA used to manually initiate a batch data transfer for many capsules' once all the requested metrologies were completed

This caused **unnecessary delays** because of waiting for the last metrology to be completed. Different metrology techniques have different data acquisition timelines.

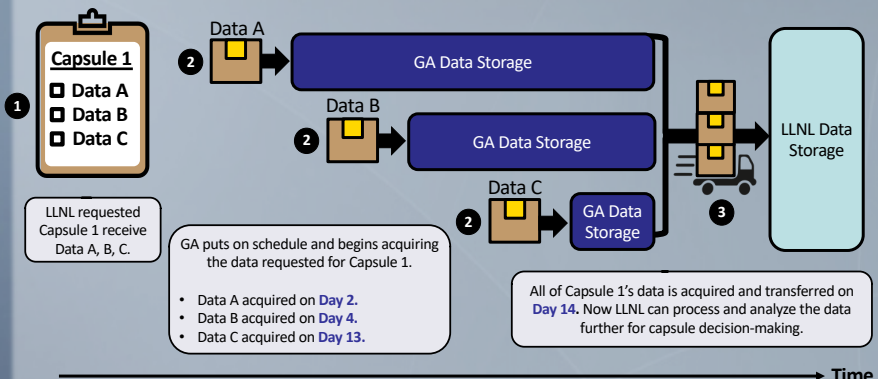
### Lack of Standardized Data Tracking

- No standardized receipts showing what files per capsule were transferred successfully to LLNL

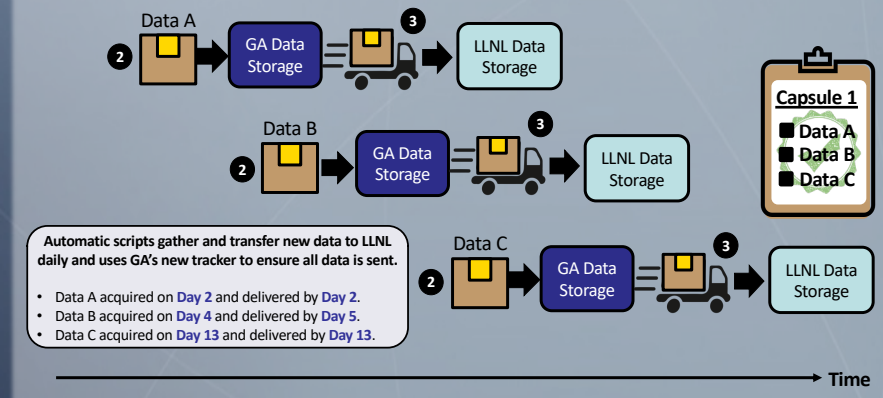
If asked the status of a specific metrology for Capsule 1, **how would anyone know unless they remembered or tediously looked for the files to check?**

## Data Transfer Flow Chart Comparison

**Before**




**After**

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