Project Harbinger+Air

What I've learned

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Overview I

- Project Harbinger+Air
- So, where's the data?
- Where is the project now?
- What we learned
- Questions

Who am I?

Just some pilot

LCDR Alex "Jarvis" Buck

- USNA '11, MIT '13
- MH-60R Seahawk Weapons & Tactics Instructor
- Mostly based from San Diego, C7F + C5F deployments
- Currently at Carrier Air Wing EIGHT in NAS Oceana

In the right place at the right time

Project Harbinger+Air

Project Harbinger+Air

Use machine learning to real-time classify acoustic contact in the spectrogram (*gram*) from an SSQ-53 series DIFAR buoy.

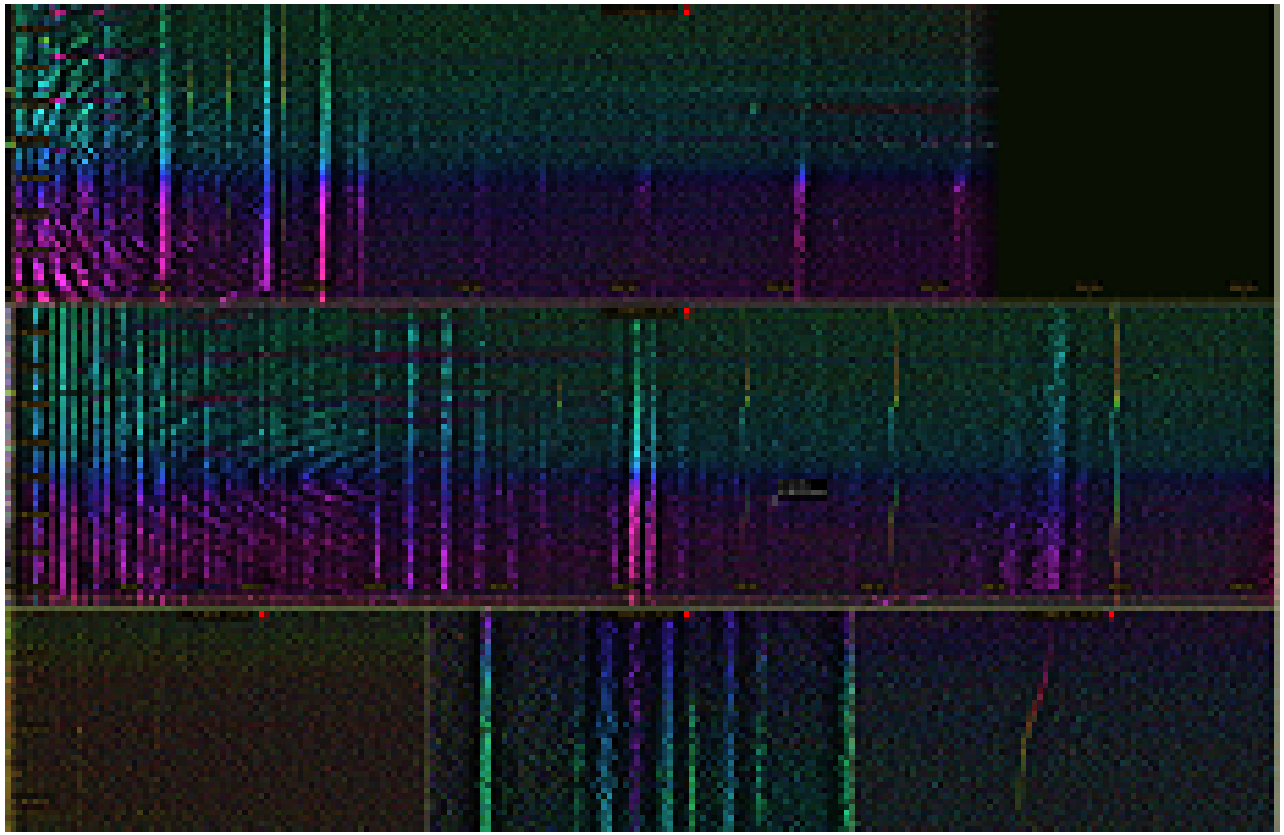

Figure 1: Example Gram Data

Needle in a Haystack

$$SE = SL - PL - NL + DI - RD$$

There are lots of things that make sound in the water other than submarines.

Finding and discriminating subsurface contact from other sources is hard.

Doing so, while managing 4 other sensors is harder.

Let my sensors monitor themselves when I am not.

So, where's the data?

What happens after a flight

. . . It gets deleted

Once any immediate debrief or VI is complete, re-format the cards.

Except ESM. . . sometimes

Previously the only mission sensor data collection effort in the MH-60R fleet.

Multiple steps for the aircrew:

- Run a program to parse ESM data (many steps req.)
- Find output in obscure folder
- Manually rename output according to specific format
- Upload output to IntelDocs

Well that's not great

The Mantra

Figure 2: Unofficial Patch

Every Byte, Every Flight

Minimize aircrew actions and decisions.

Save everything, build batch processing on the backside.
Build future value for other sensors, e.g. ISAR, FLIR, etc. . .

There are lots of bytes

- ~20 GB/flight-hour[1]
- ~240 GB/flight-day (12-hour fly day)
- ~36 TB/2-bird detachment (150 fly days)
- ~60 TB/CVN element (20-hour fly day, 150 fly days)

Not enough storage

We needed a better simple storage solution.

[1] Depends highly on what sensors are being used and recorded. Ranges from 10 to 30 GB/flight-hour.

Data Pipeline: The fleet side

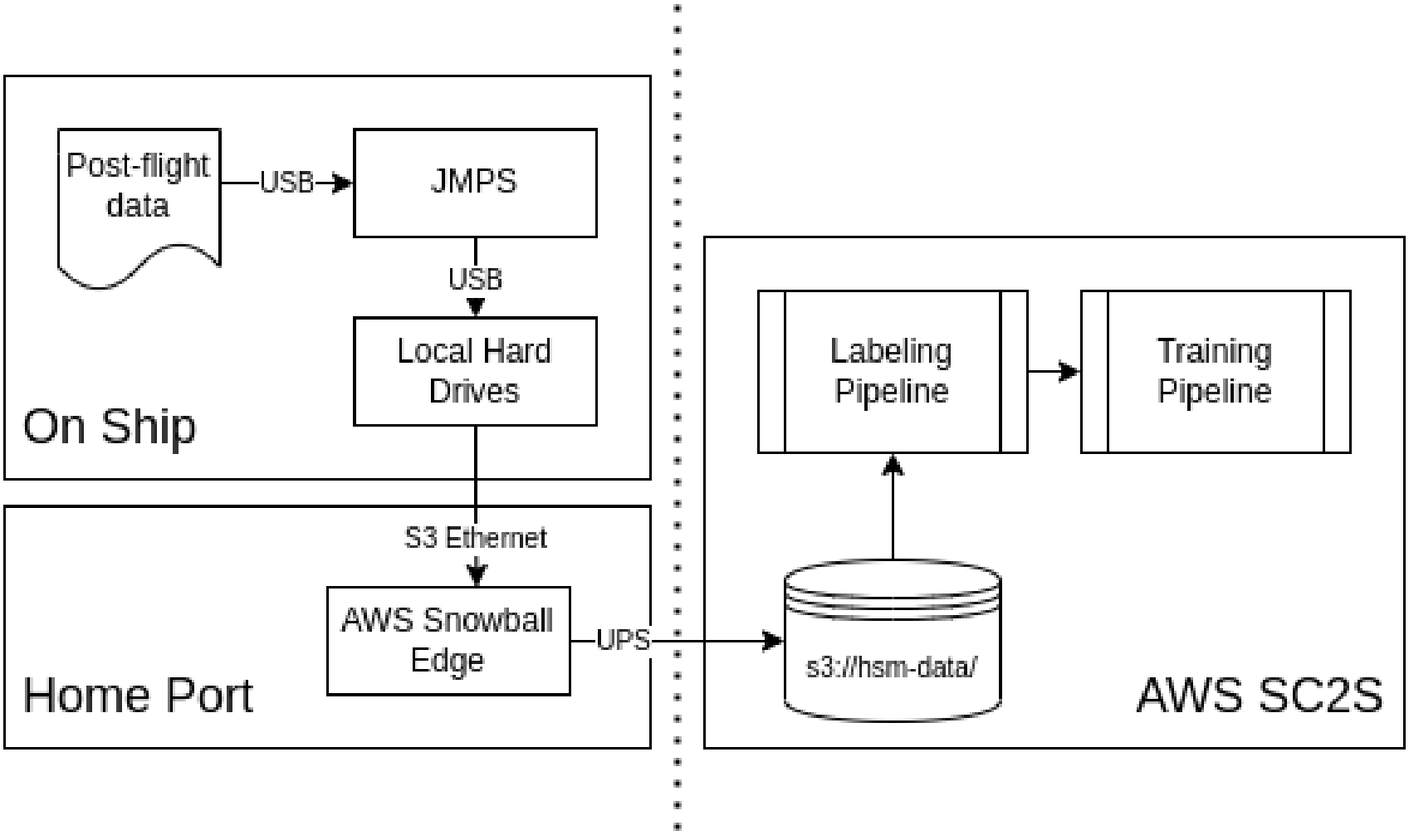

Figure 3: Data Flow

Cronus, the harvester

Open source tool[2] built on JMPS laptops that:

- Minimizes aircrew decisions
- Minimizes aircrew post-flight actions
- Automates connection to AWS Snowball Edge

Its really just a fancy copy/paste operation right now.

Initial version built in 3 weeks. Iterated with users over 4 HARPs throughout 2020 and 2021.

Usage checklist is a single kneeboard sized page.

[2] Source available at gitlab.gs.mil/hsm/cronus

Where is the project now?

Status of Harbinger+Air fleet collections

Data collection process used on **14** operational MH-60R deployments and numerous HARP classes.

Replaced Snowballs on ships with several 10TB hard drives.

Testing initial algorithm later this year on P-8A.

Roadmap to MH-60R integration is unknown.

What we learned

What we learned

No community funded systematic collection and organization of sensor datasets. Future of Harbinger+Air data collection is unclear.

To maximize adoption, minimize what the operator needs to learn to support collection.

Data collection can support aircrew training and debrief to encourage adoption.

Long-term Snowball rental is expensive if all you need is storage.[3]

Snowballs can fail. Not ideal when stuck on a ship for 6 months.

There is no secret room of data labellers. If possible, use post-flight support personnel or aircrew to label.[4]

Sandboxed mission system that does not affect flight operations expedites in-aircraft test.[5]

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[3] The first 10 days are free. Intended as dump and ship back.

[4] Transcribe aircraft ICS as a first pass at labelling.

[5] e.g. Mighty Orion system on P-8A, vice no clear path for MH-60R.

Questions