Can We Migrate Our Analysis Routines to Python?
Introduction

- Can we migrate our analysis routines to Python?
  - MATLAB is powerful, but it’s expensive.
  - Capable open-source alternatives exist and are thriving.

- Recent developments in scientific Python libraries have made migration from MATLAB to Python possible and attractive.

- The IADS Group uses multiple MATLAB licenses.
Dominance of MATLAB

• MATLAB is the standard language for engineering analysis.

• No need to be a programmer to solve engineering problems.

• Used for collaboration and development of analysis routines.

• MATLAB is required for study in an engineering curriculum - ECE 309 (CSUN), “Numerical Methods in Electrical Engineering”, is now taught using MATLAB. It was taught using Pascal in the 1980s…
Dependence on MATLAB

- IADS uses MATLAB to prototype new analysis routines.

- IADS uses MATLAB to test and maintain data export and import.

- IADS uses a set of MATLAB scripts to test Autospectrum and PSD results for Every Release.

- IADS is dependent upon MATLAB.
Problems with Dependency

• Budget constraints mean fewer licenses and toolboxes are available.
• MATLAB version changes force retest of data interfaces.
• Retest requires an active license.
• Test Scripts are unusable without a license.
• Having no backup plan in place is risky.

What happens if they take MATLAB away from us?
Requirements for a Replacement

- Should have broad industry acceptance.
- Should have scientific libraries that mimic functionality that is commonly used in MATLAB by the flight test community.
- Should have similar syntax.
- Total MATLAB functionality is not necessary for our purposes, but it would be nice for going forward.
- Should be relatively free of periodic licensing hassles.
Open-Source Alternatives

- A Google search brings these up:
  - GNU Octave
  - Scilab & Xcos
  - Python/NumPy/SciPy

Google says try these.
Gnu Octave

Octave’s Modern Development Environment
Gnu Octave

• IADS Team evaluated Octave right after MATLAB was in use.
  - User Interface was cumbersome.
  - Windows installation package wasn’t comprehensive.

• Modern Octave install with IDE warrants another evaluation.

• MATLAB and Octave are basically dialects.
  - MATLAB script can be dropped right in.
  - Some library manipulation necessary?
SciLab and Xcos

SciLab’s Modern Development Environment
Scilab and Xcos

• IADS Team also tried Scilab right after MATLAB was in use.
  - User Interface was cumbersome.
  - Windows installation package wasn’t comprehensive.
  - Syntax different enough to cause initial difficulty.

• Modern Octave install with IDE plus Simulink alternative Xcos warrants another evaluation.
Python/SciPy/Matplotlib

- Anaconda install is comprehensive – Spyder IDE intuitive.
- Can be installed free on any Windows PC.
- Syntax different enough to cause initial difficulty like SciLab.
- Wide array of available libraries is incentive to push forward.
- Plots from Matplotlib look good.
- Wide industry acceptance is hard to ignore.
- Python also functions as a general-purpose programming language.
Practical Results with Python

- Working PSD and Autospectrum test script
- Working RFP Curve Fit test script
- Bessel Filter added to IADS using SciPy for test
- Collaboration with users that do not have MATLAB is possible
- IADS Group can trim MATLAB Subscription down to one License for data interface testing.
Python Downsides

- Must translate scripts for collaboration with MATLAB users.
- There is no Simulink “clone” in Python yet.
- Requires learning new syntax and array/matrix constructs.
- Requires translation of existing MATLAB-based tools.
- Not all MATLAB functions are supported in SciPy.
  - ScyPy’s documentation lists everything available
  - New development is happening constantly.
Conclusions

- Python/SciPy are sufficient for the IADS Group to replace the MATLAB analytical capabilities used presently.
- Total elimination of MATLAB licenses is not possible or necessary for the IADS Group.
- Some combination of the open-source applications presented here may possibly completely replace MATLAB for many should the need arise.
- Python/SciPy Octave and SciLab are now serious, professional engineering analysis tools.
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Commercially available product. Numerous contracting options are available to procure IADS, including GSA contracting vehicles.

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