From Data to Knowledge

A Journey Through The Mountains Of Information

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About Chris Frost

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† Non-academic Interests: Running
Outline

- Introduction
- Development of Datalink Plotter
- Development of Wind Calc
- Related Projects
- Conclusions
Introduction

- Dynetics provides support for TUAV Project Office
  - Simulation
  - Flight test
  - Performance evaluation
- Information collected from tests is invaluable
- Magnitude of this data limits its usefulness
- New tools were required to solve these problems
Datalink Plotter

“In data analysis, a picture is worth a million rows of data!”

† Problem: UAV flights generate large volumes of hard to deal with information

† Datalink Plotter Goals:
  – Produce clean, intuitive plots so that data is easy to interpret
  – Automation of common tasks
  – Simpler, targeted interface

† Allows Dynetics and customers to have a deeper understanding of link data
Datalink Plotter Capabilities

Architecture for reading any binary data
– Currently supports the following data types found in the TUAV Datalink Specification
  • Bits
  • 8bit signed and unsigned integers
  • 16bit signed integers

Allows plotting of multiple items, synchronized with time, for event comparison
Datalink Plotter Capabilities, Continued

- Data filtering through custom and pre-built binary masks
  - Communication links often use ranges of bits which have varying purposes
  - This filtering thus lifts interleaved messages of different repetition frequencies out of the larger data pool
Uplink Packet Content

- Always 52 bytes in length
- Different message types uplinked serially
  - 2Hz A
  - 2Hz B
  - 4Hz
  - 8Hz
Uplink Packet Content, Continued

† 2Hz A Example
  – Byte 20, bits 7, 6, & 5
  – Bytes 24 & 25: Altitude

<table>
<thead>
<tr>
<th>Bit #</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
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<td>0</td>
<td>1</td>
<td>0</td>
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</tbody>
</table>

† 2Hz B Contrast
  – Byte 20, bits 7, 6, & 5
  – Bytes 24 & 25: Gain and Level

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† Result: Intertwined Data
Masking Example
Problem: Calculating wind data summaries from TUAV flights is a long, tedious process.

Wind Calc was created to find instantaneous, average, and interpolated wind summaries.

- With ability to easily be extended
Wind Calc Usage

- Three methods of interaction:
  - Single-entry call (filenames and time of event)
  - Interactive frontend
  - Batch frontend
Wind Calc Program Flow

Read data entries from high rate and low rate file repositories and perform averaging/interpolation

Convert coordinate system orientations

Save summarized data to ASCII file
Related Projects

- Variable Editor
- File Format Backend for Flight Visualization Tool
- Background Research in JMASS and sockets
Development of Variable Editor

† Purpose: Allow easy manipulation and plotting of equations for those not familiar with Matlab

† Capabilities:
  – Create and edit equations
  – On-screen input
  – Loading and saving of variables
  – Plotting
Variable Editor

Interesting Concepts Explored

- Concurrency applied to a database concept
  - Wrote a light variable database with spinlocks
- Reentrant Guide Created Figures
  - Explored novel way to address graphical objects
Dynetics is using a 3-D visualization tool to graphically demonstrate vehicle dynamics.

Began work to extend the program interface to deal with multiple file formats:

- Initially with support for SCD, JMASS, FTIP, and RAVIN

Status: On hold pending availability of necessary software.
Background Research

† Investigated porting JMASS to Windows 95/98/ME
   – JMASS uses the POSIX system call standard
   – Use Cygwin to support the system calls under Windows

† Sockets for using the flight visualization tool to display a flight in realtime
Lessons Learned

- Aspects of parallel programming
- Matlab
- Fortran
- UAVs
- GUI programming and design
- Designing, building, and delivering a product
- Life as a contractor vs. working in the Army
- Matlab GUI tools have a tendency to kill Win95/98
Conclusions

† People can gain a much deeper understanding of data, more quickly, through graphical means
   – Translating data to a usable form is the “key” to the mountains of data “lock” on information

† The development of these tools is already proving to be extremely helpful to Dynetics and the Army