The Promise and Challenge of Wireless Applications for Helicopters

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Sikorsky Aircraft
Sikorsky Product Line

- UH-60M
- S-76D
- CH-53K
- MH-60R
- S-92
- Fire Scout
- MH-60S
- H-92
- X2

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Agenda

The Impact of Wires

Helicopter Wireless Challenges

Sikorsky Wireless Roadmaps
Harness Lead Time

Thousands of Miles, Millions of Dollars
Increasingly Data Intensive
Wire Drives Assembly Flow Time
S-92: 650 Lbs of Wire

423 Lbs of Wire Carry Data
1200 Wire to Vehicle Interfaces
## Harness Weight - pounds (ROM)

<table>
<thead>
<tr>
<th>Model</th>
<th>Power Wire</th>
<th>Data Wire</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>UH-60M</td>
<td>205</td>
<td>380</td>
<td>585</td>
</tr>
<tr>
<td>S-92</td>
<td>227</td>
<td>423</td>
<td>650</td>
</tr>
<tr>
<td>MH-60S</td>
<td>196</td>
<td>364</td>
<td>560</td>
</tr>
<tr>
<td>MH-60R</td>
<td>329</td>
<td>611</td>
<td>940</td>
</tr>
<tr>
<td>CH-53E</td>
<td>259</td>
<td>481</td>
<td>740</td>
</tr>
</tbody>
</table>
CH-53K Will have 1350 lbs of Wire

Large + Highly Integrated = Lots of Wire

Wire is 3.5 % Of Weight Empty
Harness Creates Inertia to Change

Wireless is physical manifestation of Open Architecture
Benefits of Wireless to Sikorsky

- Lead Time Reduction in Design and Fab
- Eliminate 1000+ design interfaces
- Simplified Final Assembly
- Weight Reduction
- Part Count Reduction
- Increased System Upgrade Flexibility
- Increased Retrofit potential (HUMS)

*A rare opportunity to dramatically reduce complexity*
## Wireless Feasibility

<table>
<thead>
<tr>
<th>Feature</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Rates</td>
<td>✔️</td>
</tr>
<tr>
<td>Range</td>
<td>✔️</td>
</tr>
<tr>
<td>Cost</td>
<td>Promising</td>
</tr>
<tr>
<td>Weight</td>
<td>✔️</td>
</tr>
<tr>
<td>Size</td>
<td>✔️</td>
</tr>
<tr>
<td>Power</td>
<td>✔️</td>
</tr>
<tr>
<td>Multiple Operations / Devices</td>
<td>Promising</td>
</tr>
<tr>
<td>Redundancy</td>
<td>Promising</td>
</tr>
</tbody>
</table>
Wireless Feasibility and Risk

- Likelihood
  - 1
  - 2
  - 3
  - 4
  - 5

- Consequence
  - 1
  - 2
  - 3
  - 4
  - 5

- Interference
- Reliability
- Jam Resistance
- Security
- Probability of intercept

Likelihood vs. Consequence matrix:
- Likely and high consequence: Interference
- Likely and low consequence: Probability of intercept
- Unlikely and high consequence: Reliability
- Unlikely and low consequence: Security

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Helicopter Challenges

- Large Rotating Parts
- High Mechanical complexity
- Complex RF Path
- High Density of Systems, shorter runs
- Uncontrolled Operational Environment
Uncontrolled Operational Environment
Sikorsky Wireless Experience

Onboard Wireless LAN with Internet

Situational Awareness PDA for Parajumper
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<th>Walk</th>
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<tr>
<td>Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test</td>
<td>Wire Redundancy</td>
<td>Critical Display</td>
</tr>
<tr>
<td></td>
<td>Non Critical Control</td>
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- Increasing Data Integrity
- Increasing Data Rates
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Wireless HUMS & Entertainment

Wireless Instrumentation for Flight Test
Products Sikorsky Wants to Buy

- Wireless Test Instrumentation Systems
- Wireless HUMS
- Wireless Conversion Device for Legacy Systems
- Certified Aircraft Wireless Ethernet Style LAN
End State

Systems have wireless LAN connectivity
Same day Plug and Play

Outlet style power and network distribution

10X use of health monitoring

Wireless active blade control

30 Day aircraft lead time