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Unmanned Aircraft Systems Net-Centric Interoperability Anomalies

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“Rules”

- **Please keep all discussion unclassified**
  - Observations are generic and hypothetical environments and scenarios
- **Ask non-system specific questions**
- **Do not reveal any mission or operational association**

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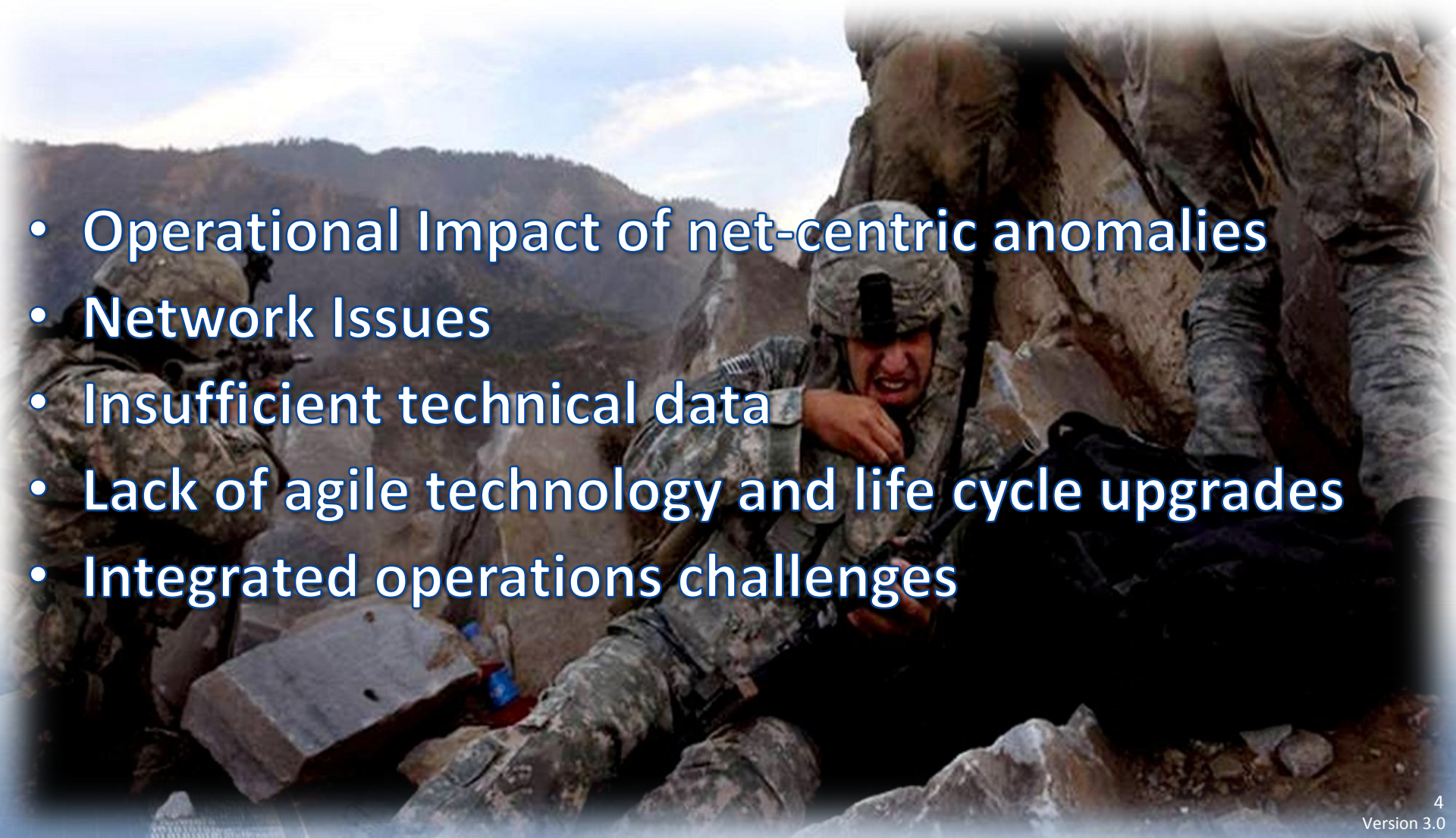
Overview

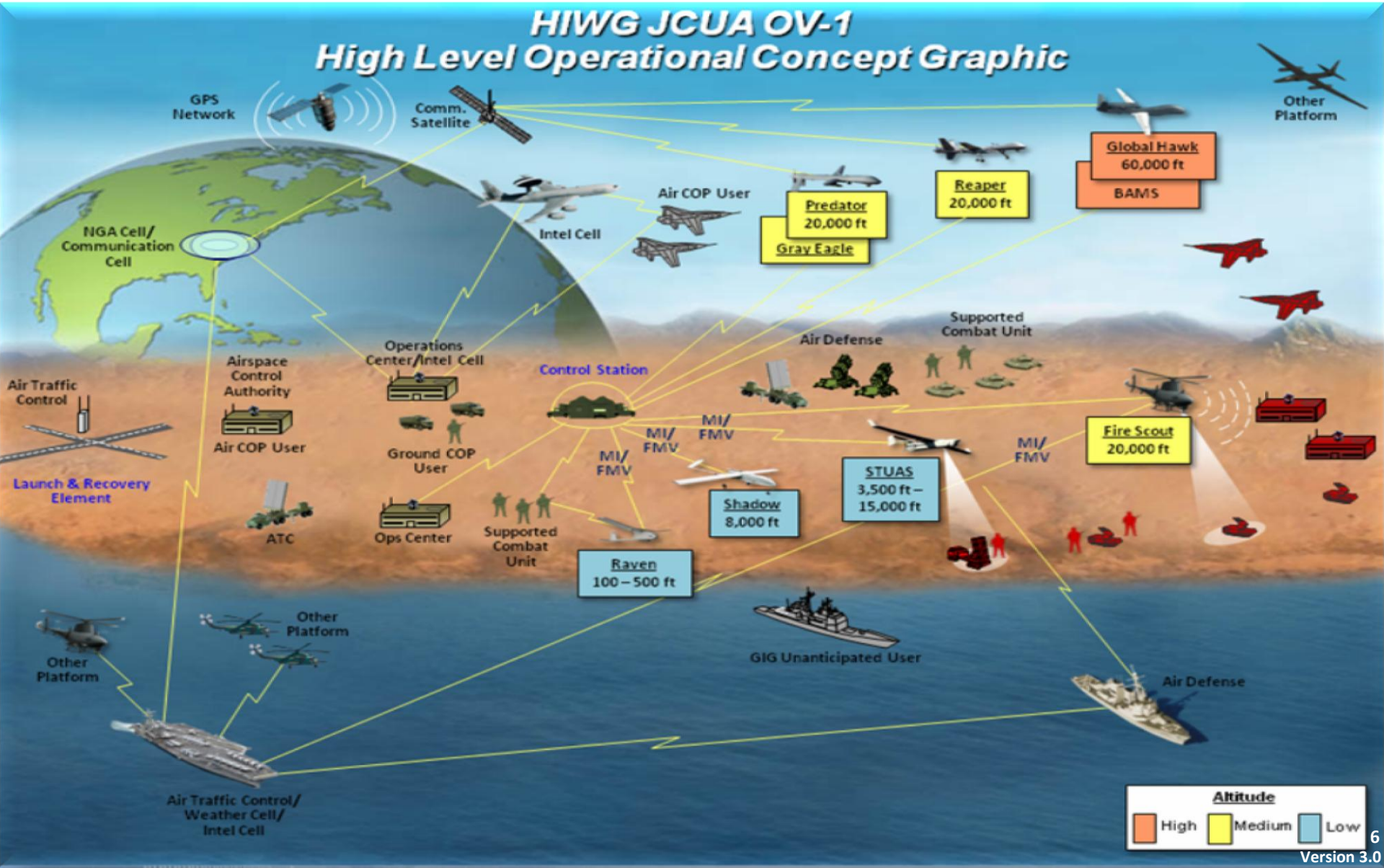


- Operational Impact of net-centric anomalies
- Network Issues
- Insufficient technical data
- Lack of agile technology and life cycle upgrades
- Integrated operations challenges

Operational Impact of Net-Centric Anomalies

- **Operating Environment**
  - Programs produce unique aircraft/ground segments
  - Operators need complete end to end solutions, including Unmanned Arial Surveillance (UAS) combined data and operation centers
- **Impacts**
  - Operators burdened with development
  - End to end network connectivity difficult
- **References/Reports**
  - JITC System Tracking Program (STP)
    - http://jitc.fhu.disa.mil/stp_info.html
  - JITC Joint Interoperability Tool (JIT)
    - http://jitc.fhu.disa.mil/jit_info.html

Horizontal Integration Working Group (HIWG) Joint Common Unmanned Architecture (JCUA)



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Inappropriate IP Addresses

- **Inappropriate use of IP network addresses**
  - Non-DoD assigned addresses/some addresses actually assigned to foreign countries
  - Addresses hard coded in compiled software
  - Public within private and address repeated
  - Works as a stove-piped system, not as a Global Information Grid (GIG)-enabled system-of-systems
- **Suggested solution**
  - Appropriate network addresses from respective Services' Defense Information Systems Agency (DISA) field office
  - Design aircraft and ground segments as actual nodes on the GIG, not isolated entities

Network Issues

- **Lack of insight on ports, protocols, and services**
  - Who or what am I talking to?
  - No access control lists/systems delivered wide open
- **Suggested Solution**
  - Full disclosure of assigned ports, protocols, and services in system technical data
- **Insufficient consideration for latency and jitter**
  - Some payloads require deterministic-like network
  - Pure IP Ethernet solutions may lose payload data
- **Suggested solutions**
  - Examine complete end to end path - aircraft to user
  - Insertion of deterministic-like network solutions
  - Use resources such as Army's Common Operating Environment
    - http://ciog6.army.mil/ArmyEnterpriseNetworkVision/tabid/79/Default.aspx

Insufficient Technical Data

- **Lack of full system documentation causes**
  - Frustration when it comes to operational system configuration, troubleshooting, and maintenance
  - Delays in preparation of systems for missions
- **Suggested solution**
  - Need full disclosure of system theory of operation in technical orders
  - Deliver baseline configuration data to facilitate proper network management

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Lack of Agile Upgrades

- **Inconsistent hardware/software maintenance**
  - Data Links slow to modernize to latest standards
  - Diminishing Manufacturing Source (DMS) issues
  - Critical scripts are written at operating system levels requires excessive regression testing
  - COTS operating systems and applications not being updated
- **Suggested solutions**
  - Code software applications in upper layers
  - Enable viable patch management for Commercial, off-the-shelf software (COTS)
  - Plan for frequent technology refresh

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Integrated Operations

- **Vehicles and control segments developed as stand alone capabilities**
  - Actual use exceeded expectations
  - Operators need integrated systems of systems
  - UAS data and operations centers were born
  - Use of common tools across networks blossomed
  - Interoperability and integration problem surfaced immediately
- **Suggested solution**
  - Rethink UAS system design philosophy
  - Plan for adaptable baselines for multiple and dynamic integrated operational environments

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Summary

- **Operators need integrated mission capabilities**
  - Avoid designing UAS systems with network issues
  - RF links passing network data are just as much part of the DoD Global Information Grid as land based
- **Need to strive for**
  - End to end network architecture maintained and documented as operations employs systems to include mapping to end users
  - Complete system design in technical orders
  - Readily updatable and upgradeable system designs
  - Mission partner collaboration

Resources

- **Evolving resources**
  - Joint Common Unmanned Architecture (JCUA)/OSD UAS Task Force initiatives
    - http://interoperabilityipt.org/page/organization
  - Universal Systems Interoperability Profiles (USIP) for standards
    - https://software.forge.mil/sf/go/proj1887
    - https://gtg.csd.disa.mil/uam/homepage
  - OSD Unmanned Information Repository (UWIR) for the 29 identified joint interoperability gaps stated in the Unmanned Aircraft Systems Interoperability Initiative Capabilities Based Assessment Final Report
    - https://extranet.acq.osd.mil/uwir
    - https://extranet.acq.osd.mil/uwir/docs/UI2%20CBA%20Report%20Final%20Signed.pdf
  - JCIDS Net-Ready KPP process
    - https://www.intelink.gov/wiki/Net_Ready_Key_Performance_Parameter_(NR_KPP)_Manual

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Back Up Slides

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Operational Impact of Net-Centric Anomalies

- **Operating Environment**
  - Programs produce unique aircraft and ground segments
  - Operators need combined data and operation centers to gain system and data synergies necessary to execute missions
- **Impacts**
  - Operators burdened with assembling non-baseline solutions to achieve interoperability and mission synergies
  - Anomalies in unmanned system designs exacerbate ability to perform end to end network connectivity
  - Must ensure net-ready key performance parameters vigilance applied throughout life cycle

Network Issues

- **Inappropriate use of IP network addresses**
- **Observations**
  - Non-DoD assigned addresses
  - Addresses actually assigned to foreign countries
  - Addresses hard coded in compiled software
  - Public addresses within private address segments
  - Use of a single address repeated among all similar equipment
- **Suggested solution**
  - Request program office obtains appropriate network addresses from respective Services' DISA field office
  - Consider the aircraft and ground segments as actual nodes on the global information grid – not isolated entities!

Network Issues (cont)

- **Lack of insight on ports, protocols, and services**
  - Observations
    - Inability to determine actual remote procedure calls vs assigned ports
    - Systems delivered wide open with no access control lists
  - Suggested Solution
    - Provide full disclosure of assigned ports, protocols, and services in system technical data
- **Insufficient consideration for latency and jitter**
  - Observations
    - Certain payloads may require deterministic-like network
    - Pure IP Ethernet based solutions may buffer data or drops packets that could lose the sensitive type of payload data
  - Suggested solutions
    - Examine complete end to end path from aircraft to user
    - Consider insertion of deterministic-like network solutions

Insufficient Technical Data

- **Observations**
  - Lack of system insight causes:
    - Frustration when it comes to operational system configuration, troubleshooting, and timely maintenance
    - Delays preparation of systems for missions
  - Dependence on Contracted Field Service Representatives
    - May not have obligation to adhere to DISA or service instructions and guidance
- **Suggested solution**
  - Need full disclosure of system theory of operation in technical orders
  - Deliver baseline configuration data to facilitate proper network management
  - No “Proprietary Information” used as a disclosure obstacle

Lack of Agile Technology and Life Cycle Upgrades

- **Inconsistent hardware and software maintenance**
- **Observations**
  - Data Link revisions slow to modernize to latest standards
  - Hardware company evolutions/bankruptcies
    - 90's technology still fielded, plans to replace slow
  - Diminishing Manufacturing Source (DMS) issues
  - Critical scripts are written at operating system levels requires excessive regression testing
  - Commercial operating systems and applications running years without being updated
- **Suggested solutions**
  - Properly code software applications written in upper layers
  - Enable viable patch management for commercial software
  - Plan for ever advancing technology in system design