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Fuzing in an Optimized, High Speed, Penetrating Ordnance

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Outline

1. Major Components of a High Speed Penetrating Ordnance
2. Commodity Design Approach Assumes Legacy Interfaces
3. Advanced Requirements Force Fresh Look
4. Back to the Fundamentals: Systems Engineering 101
5. Approach to Develop the Conventional Survivable Ordnance Package (CSOP)
6. Application to CSOP
7. Effect on the Fuze
8. Lessons Learned
9. Summary

Major Components of a High Speed Penetrating Ordnance

- Warhead
  - Survive the event
  - Stable terradynamics
  - Maximize explosive volume
- Explosive
  - Blast effect (high brisance, fragmentation, etc)
  - IM
  - Survive penetration event
- FUZE
  - Survive penetration event *and FUNCTION*
  - *High reliability in all phases (safe, arm, fire)*

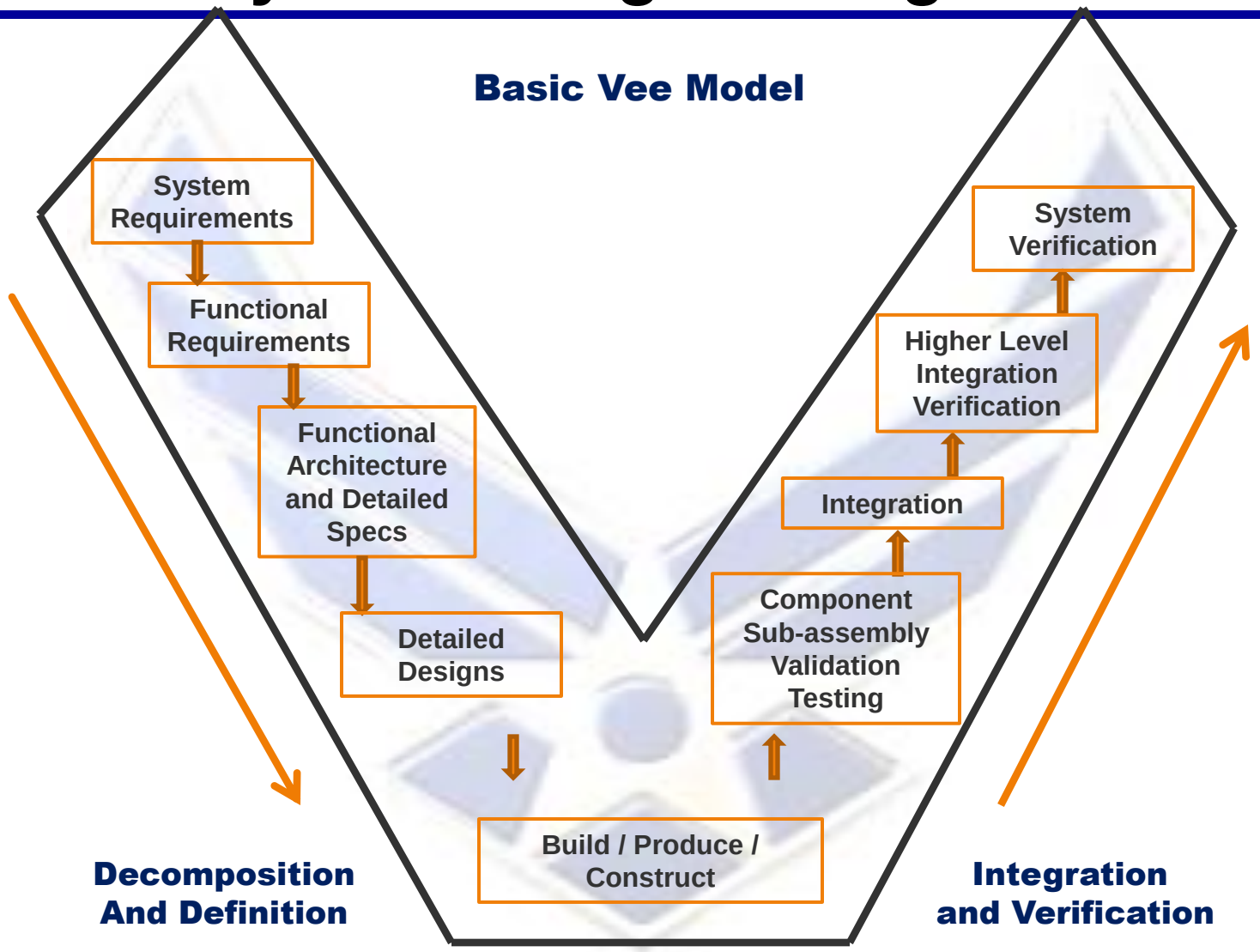
Commodity Design Approach Assumes Legacy Interfaces

- Fuze to Warhead
  - Tail mounted
  - 3 inch diameter cylinder
  - Legacy Fuze Well
  - Compression mount or cantilever mount
- Fuze to HE Fill
  - Booster shape and size pre-determined
  - Complex physical interface pre-determined
  - One variable to assure reliable ignition—Auxiliary Booster
- Warhead to HE Fill

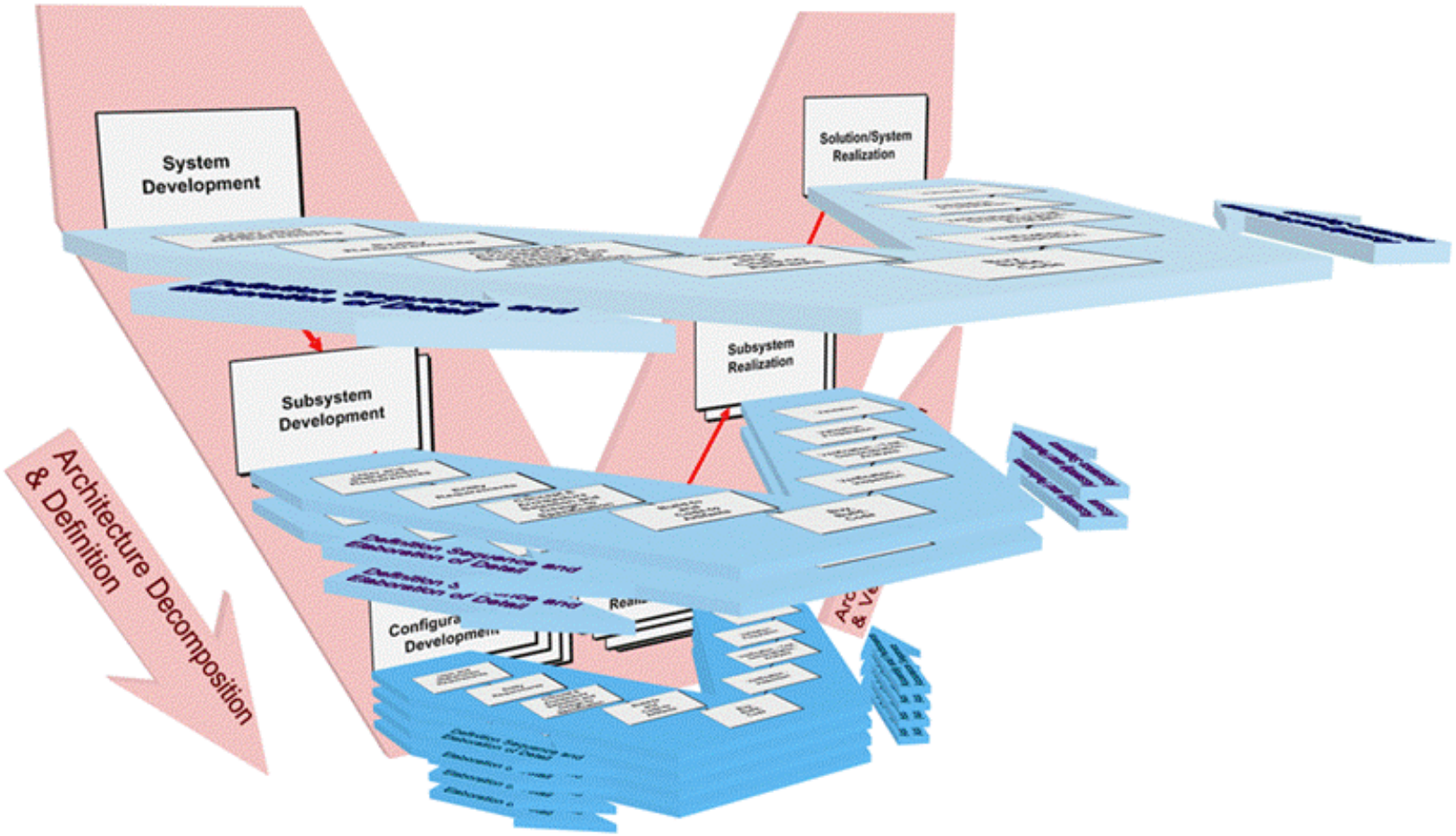
Advanced Requirements Force Fresh Look

- More, more, more
  - Effects
  - Safety
  - Reliability
- Harsher Environments
  - Faster
  - Harder
  - Hotter

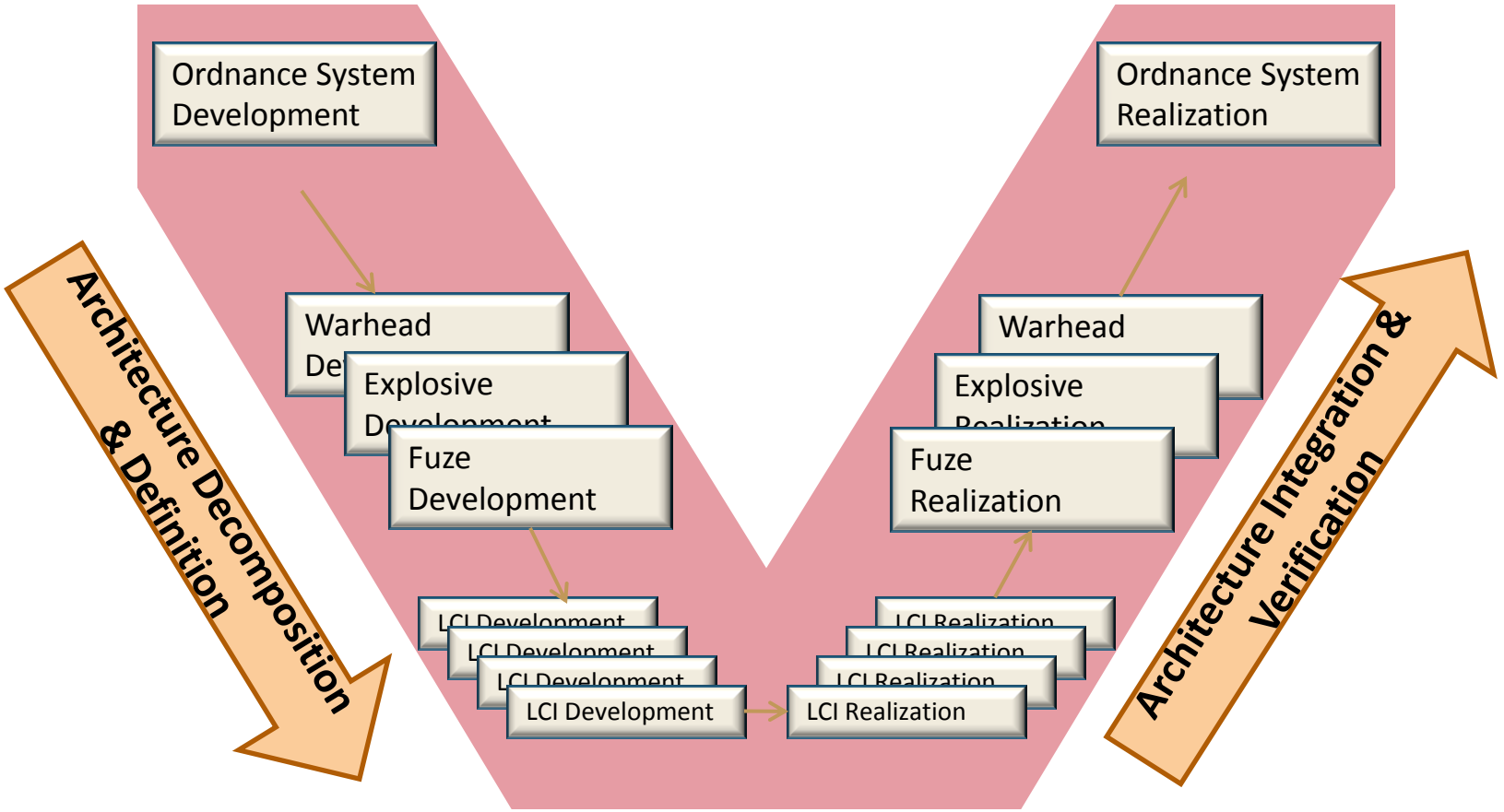
Back to the Fundamentals: Systems Engineering 101



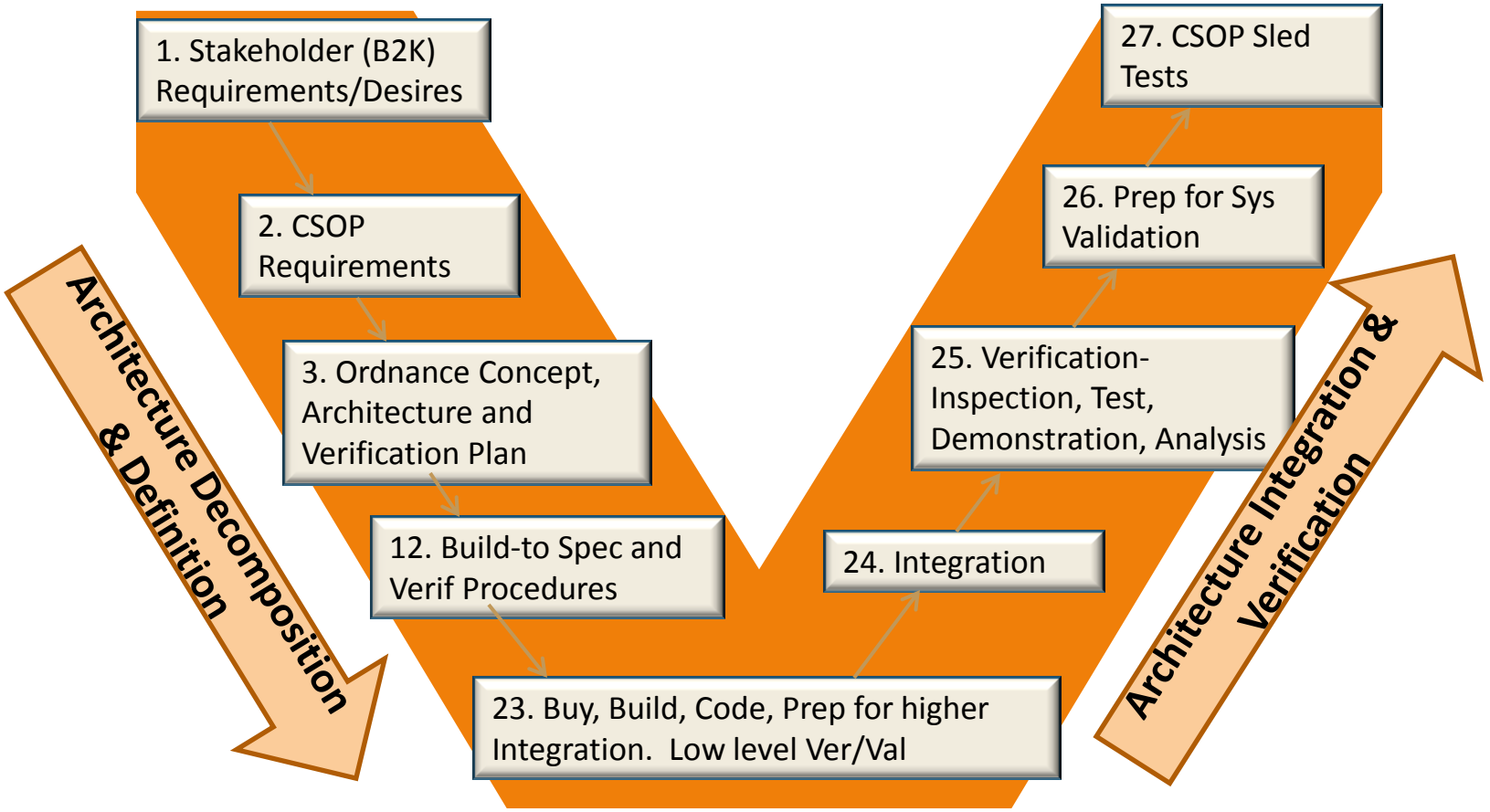
Dual V-model Systems Engineering Process



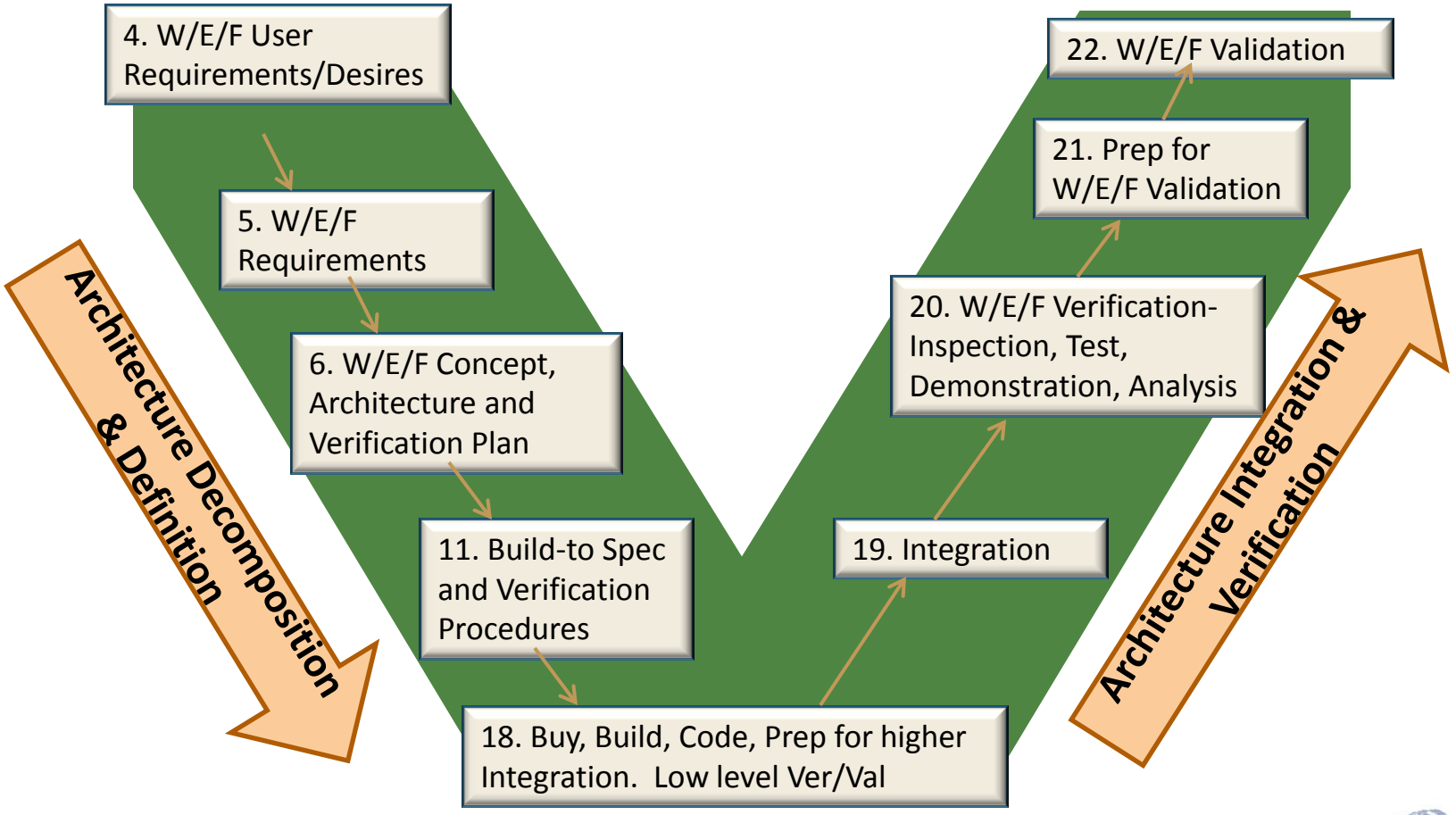
Approach to Develop the CSOP
CSOP System Realization V



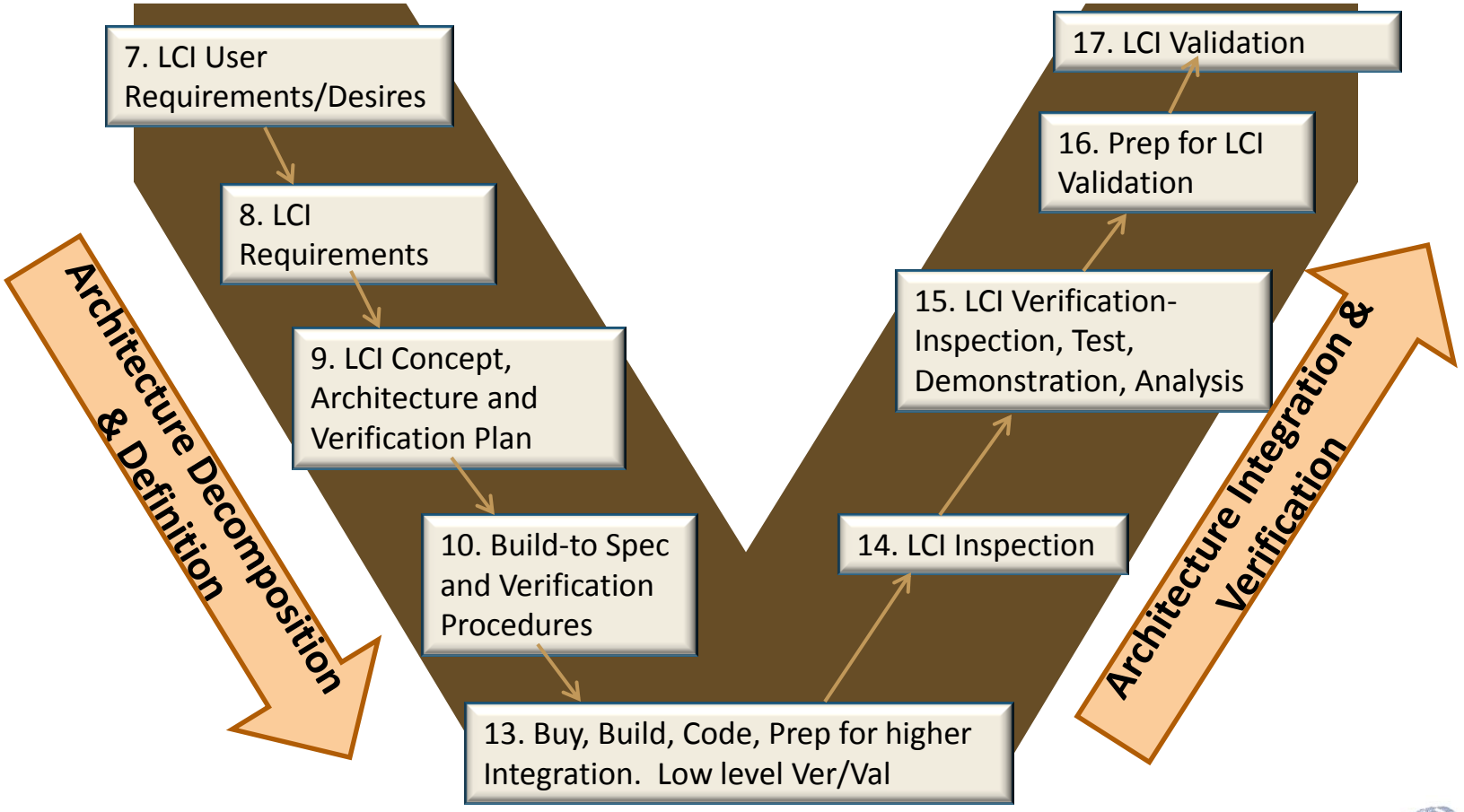
Top Tier V Development



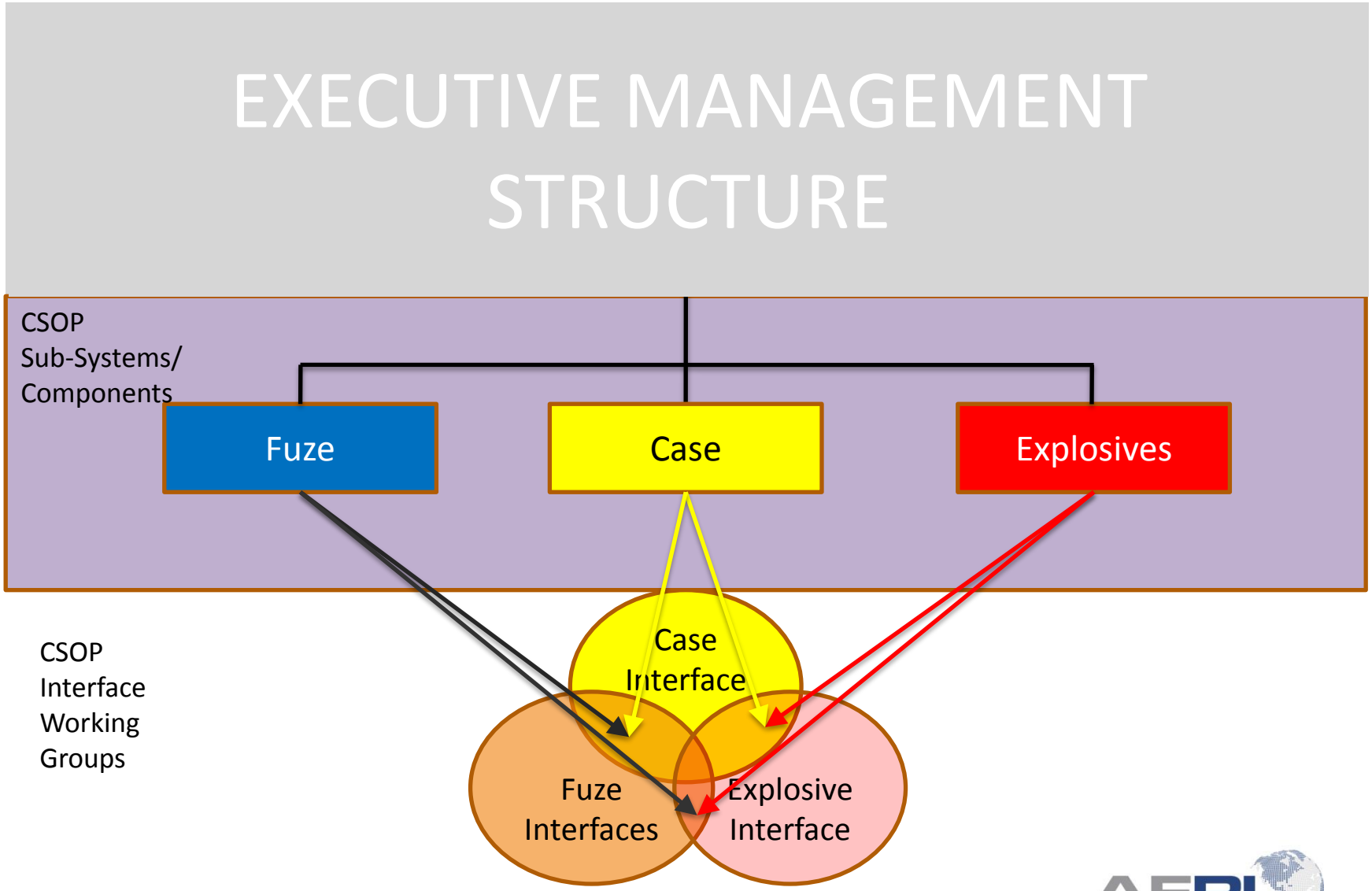
Subsystem Tier V Development



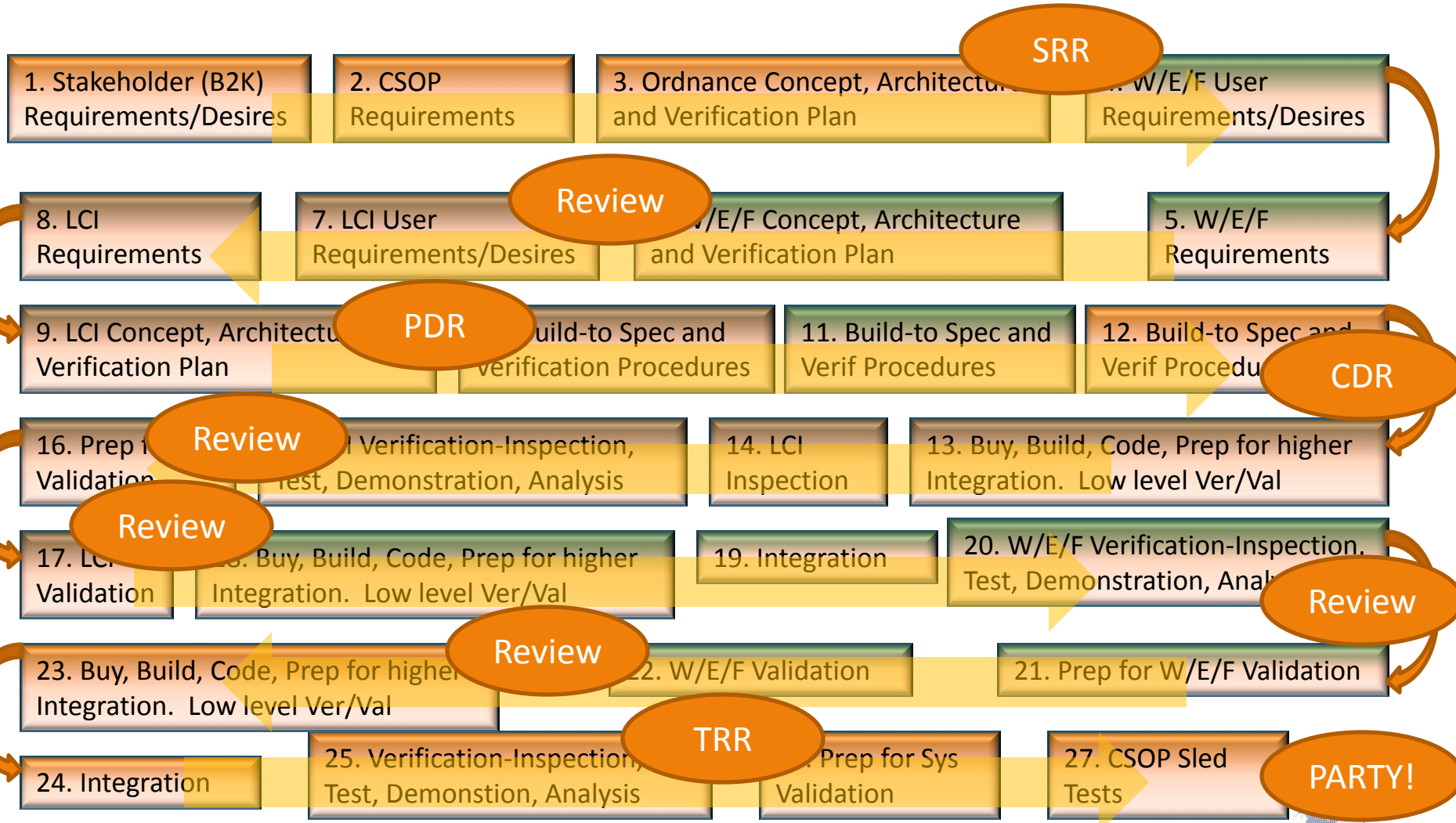
Lowest Configuration Item Tier V development



Application to CSOP



Systematic Task Flow from V



Effect on the Fuze

- Fuze functionality (S&A, explosives, survivable module) distributed
- Survivable module iterated three times to assure robustness
- Explosive train iterated three times to assure reliable ignition

Lessons Learned

- The optimized system solution is not necessarily the optimized component solution
- Don’t cut corners when the schedule gets tight—it will bite you almost always
- Time well spent at the beginning increases the probability of success at the end

Summary

- The fuze can no longer be treated as a commodity component
- Treat all ordnance components as part of the weapon system optimized solution
- Distributed fuzing concepts can facilitate optimization

Questions?