

Innovative Modular Facility Design

Changes In Biopharmaceutical Facility Design

Earlier Designs

- Generally Purpose Built
- Bespoke Designs
- Process Coupled to the Facility
- Often to Produce Large Volume:
- Often Single Product
- Stick Built
- Inflexible
- Difficult to Modify & Expand / Re-Purpose



- New Modalities
- Move to Smaller Patient Populations
- Need for Flexible Spaces for Quick Turnaround
- Rapid Deployment
- Need for Predictable Schedules
- Use of Modular II Systems /Pods
- Smaller Agile Facilities
- Generic Agonistic Platforms
- Multi Product
- Speed to Market
- Regional Manufacturing

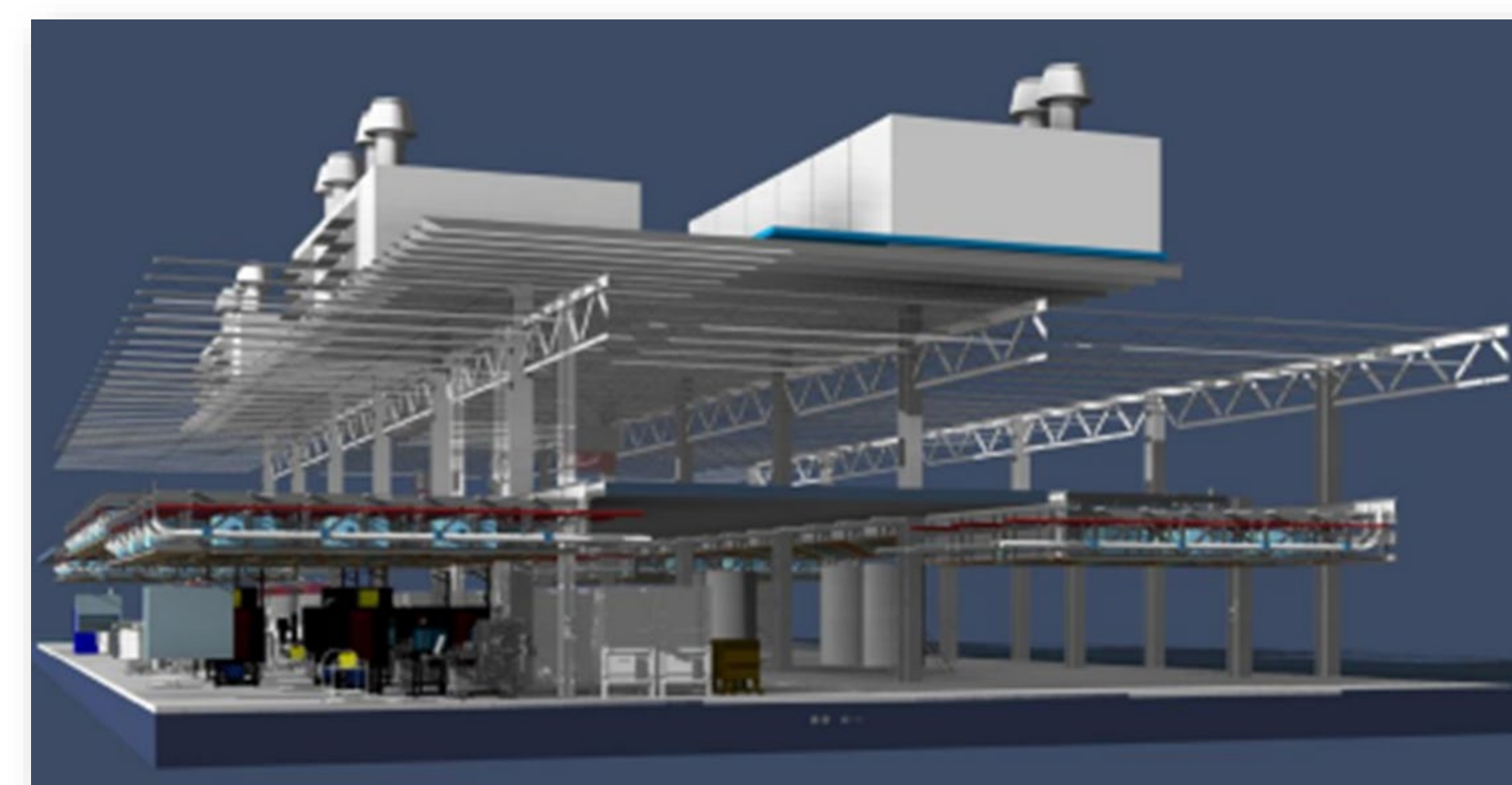
- Increase in Automation & Robotics
- Defer Capital Investment
- Move Toward Off-Site Operations
- Use of Standardized Repetitive Design
- Reduce Impact on Qualification Times
- Ability to Re-Purpose/Simpler Designs
- Looking to Reduce Design Time & Cost
- Use of digital twins



Modular Facility of the Future

Standard Integrated Modular Platform

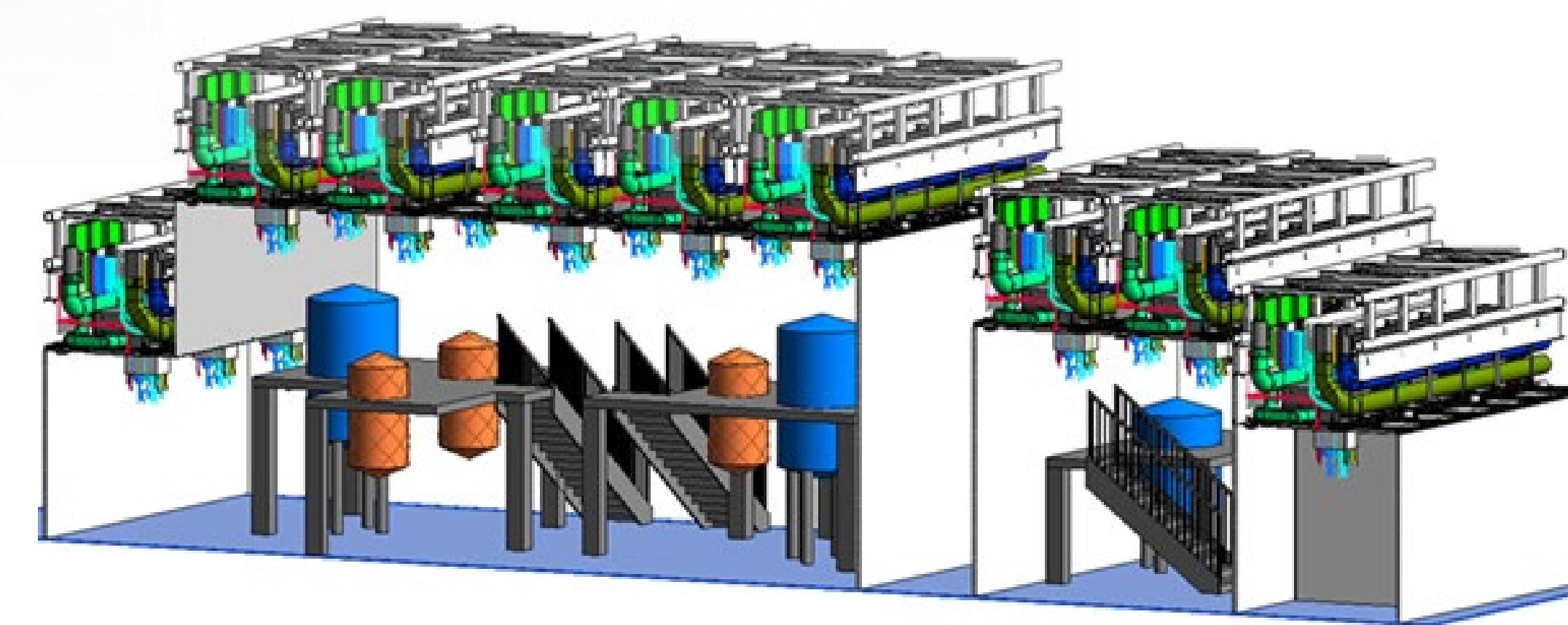
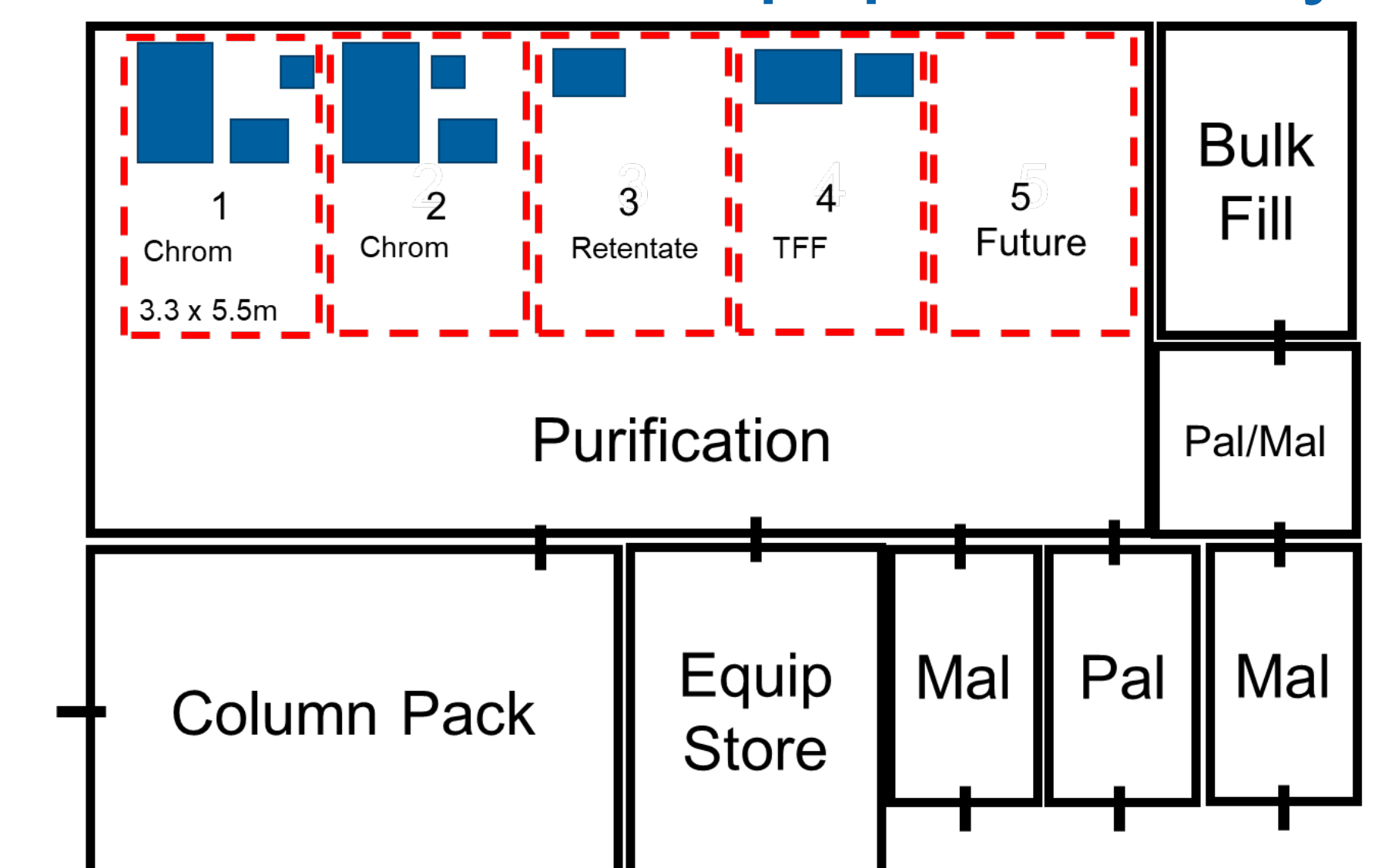
- Highly Flexible Plant Design from Standard Building Blocks
- Cost Certainty Through Standardization
- Adaptable to any Biotech Single-Use
- Ballroom Layout Ready
- Standardized Architectural Grid
- Free Integration of Standard Process & Utilities Skids
- Clean Room Height Adapted to Process Needs
- Ready for Future Reconfiguration & Refurbishment
- 50% Faster Time to Market



Scaling Out Vs. Scaling Up

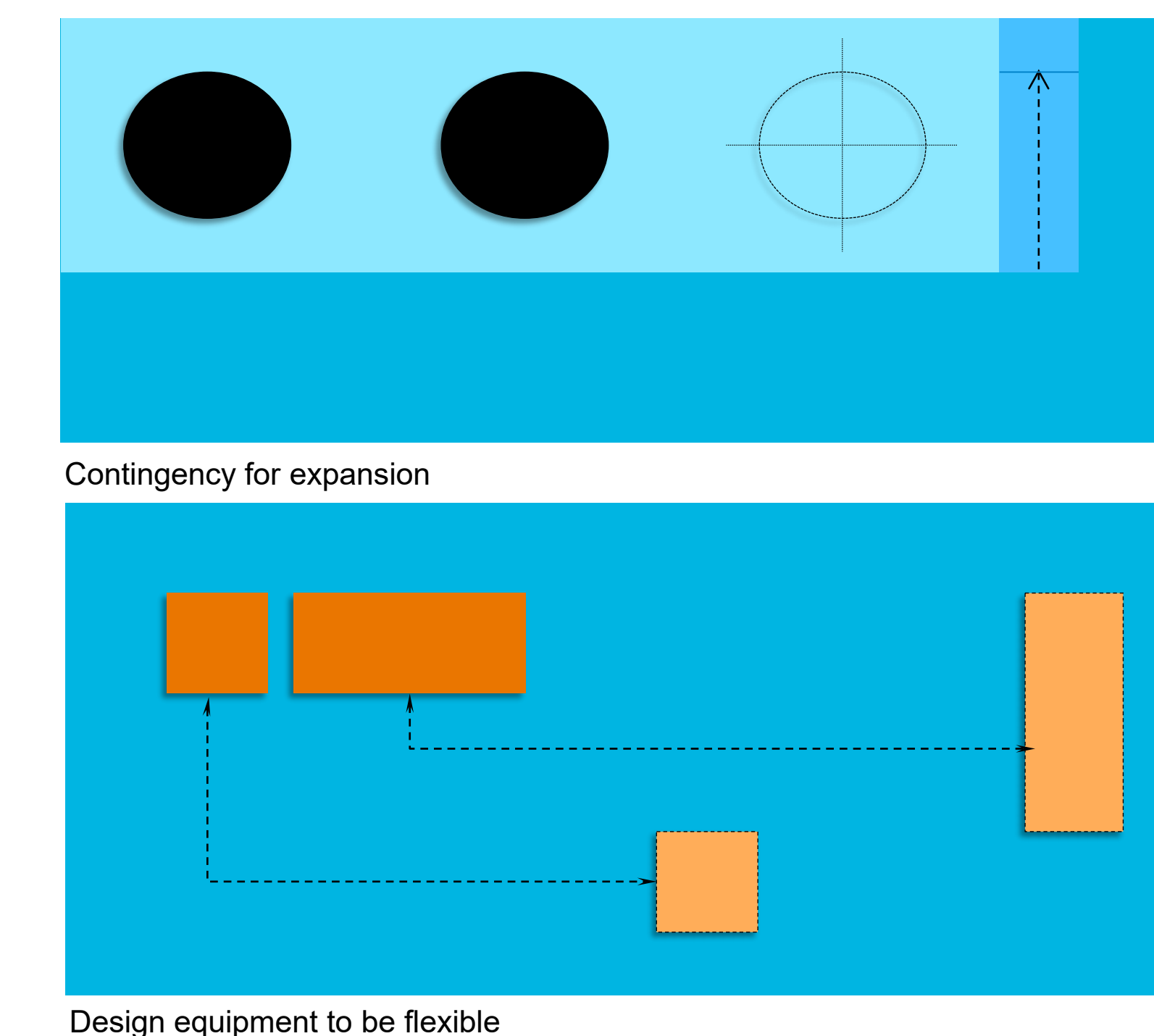
- Enables Single-Use Bioreactor Technology to Replace Traditional Stainless Steel, Fixed-Tank Bioreactors in Commercial Manufacturing Plants
- Reduces Product Quality & Process Performance Scale-Up Risks
- Flexible Process Design & Validation Strategies
- Accommodates a Wide Range of Product Levels & Market Demands
- Ability to Phase Works
- Potential Reduce Capital Investment

Standardized Equipment Bays

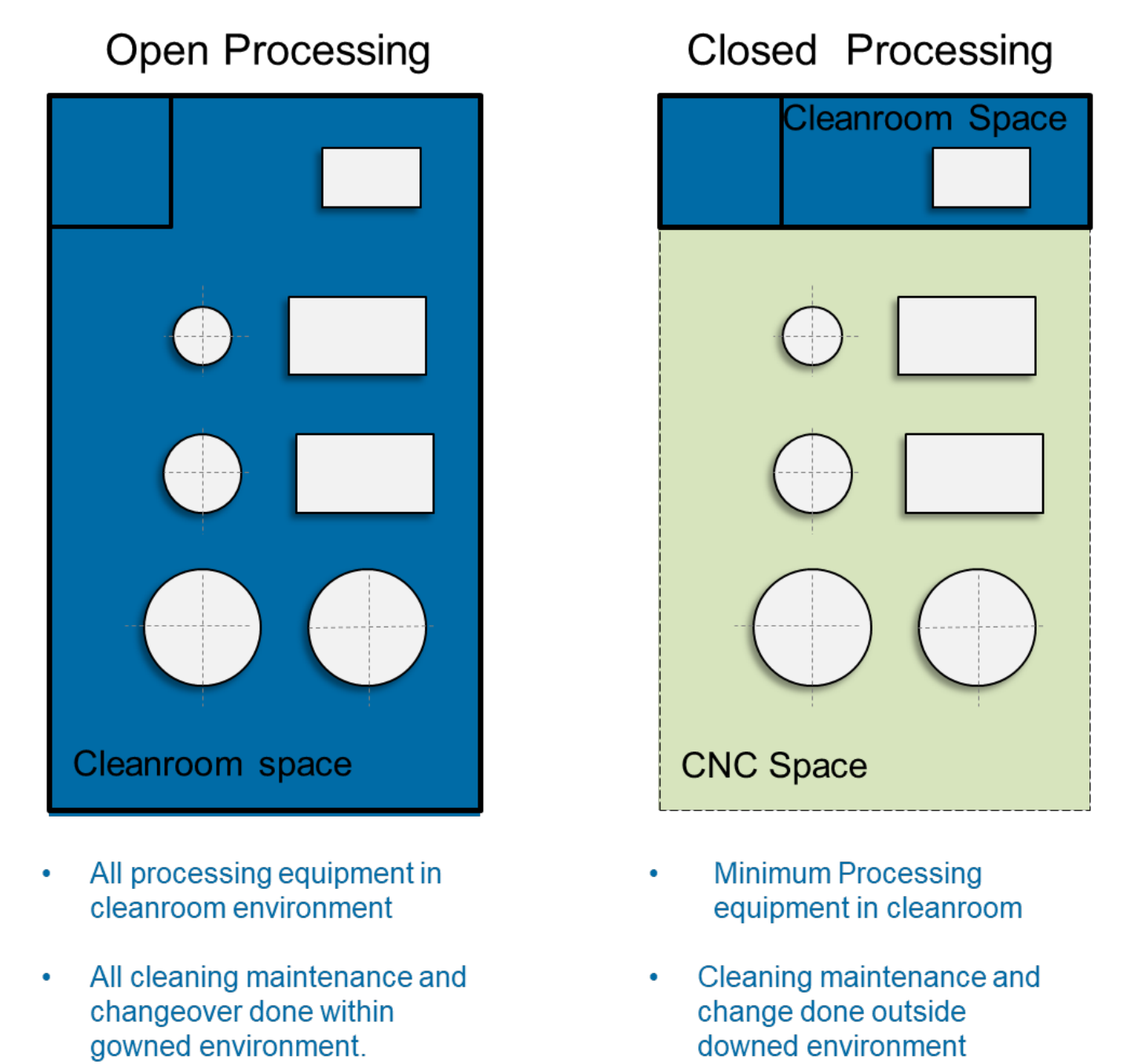


Flexible Production Spaces

- If the product is successful, how can the facility expand
- If the product is unsuccessful, how can the facility adapt....
- How to decouple equipment from the facility

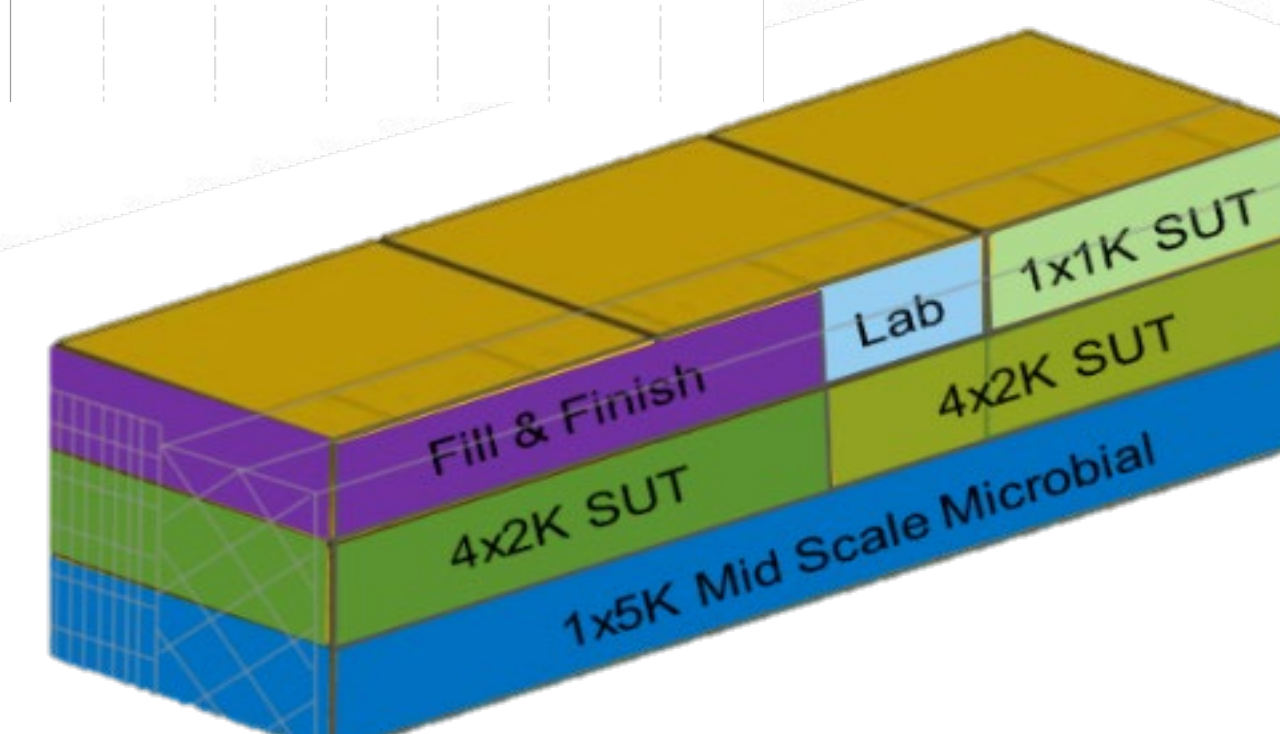
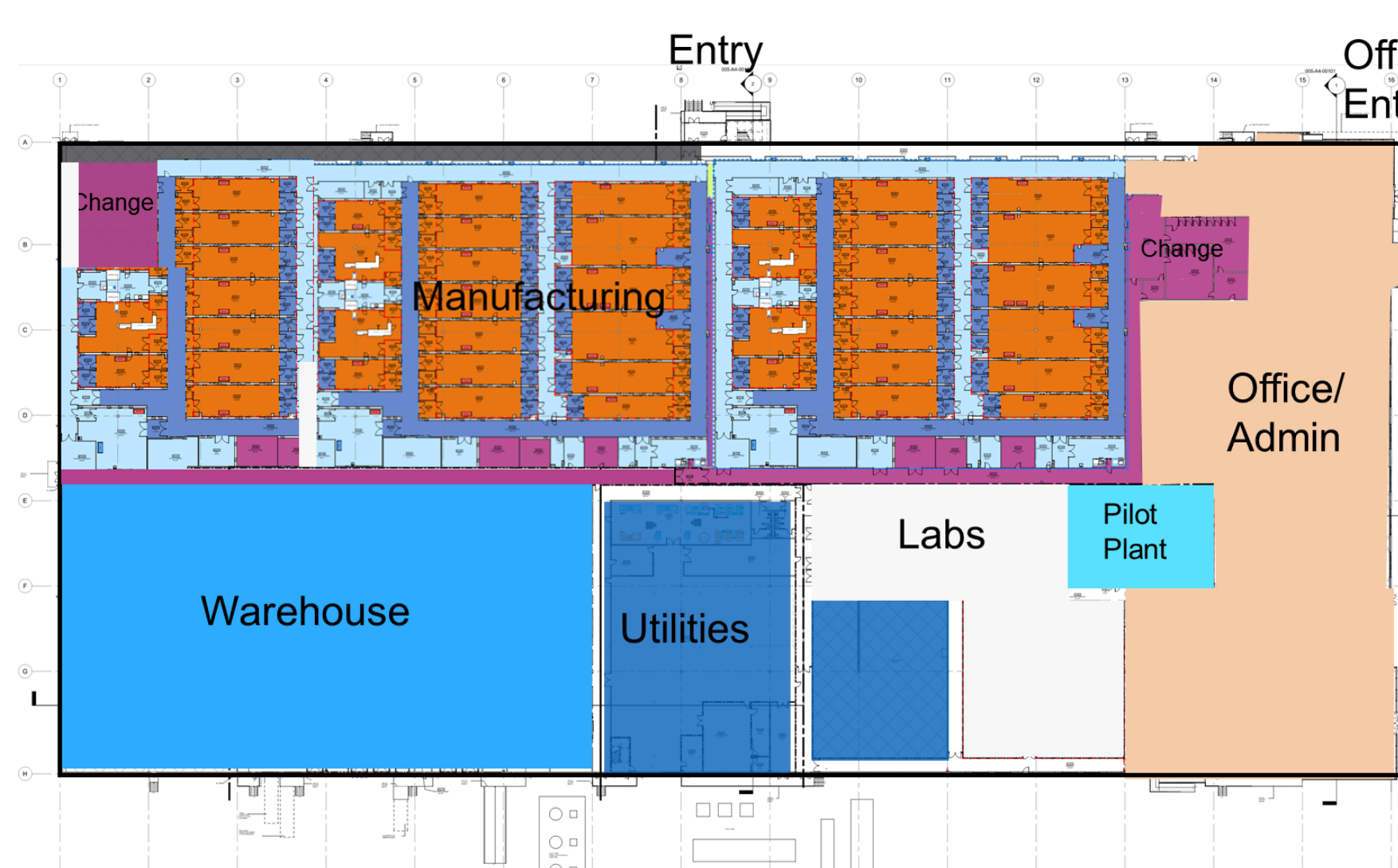
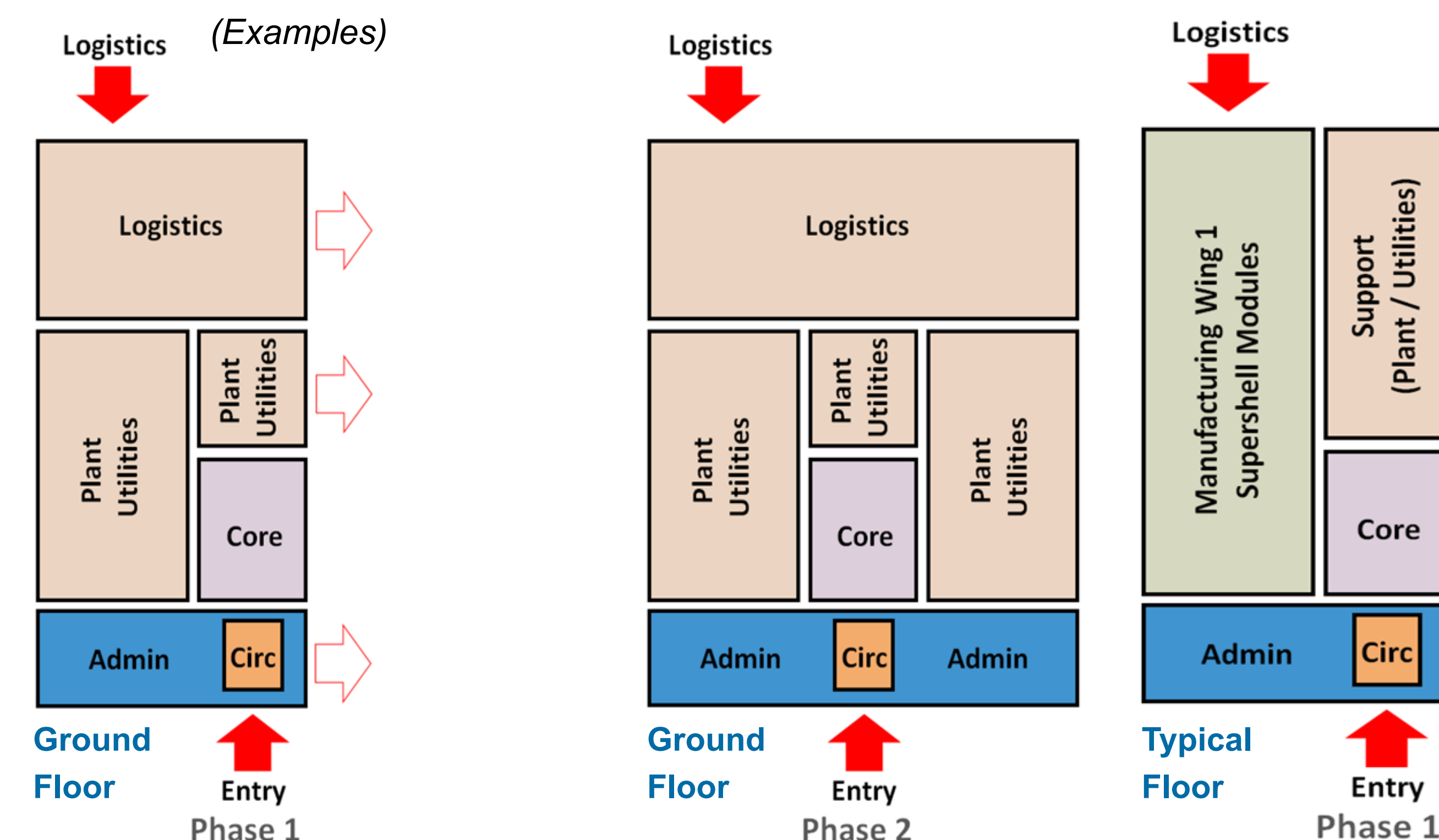


Closed Processing



Future Trends

Modular Facilities



- Enhanced Conceptual Tools for Design
- Flexible Spaces for Quick Turnaround
- Standardized Spaces & Designs
- Increased Single Use Systems
- Rapid Deployment - Pods/Modular Systems
- Decoupling Process from Facility
- Smaller Agile Facilities
- Generic Agonistic Platforms
- Use of plug & Play
- Re-Purposing of Existing Non-Pharma Facilities
- Digital Manufacturing / Use of Digital Twins
- AI & AR / Robotics
- Reduction in Human Interventions

