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Gen 3 Particle Pilot Plant (G3P3):

Integrated High-Temperature Particle System for CSP

PI: Clifford K. Ho

Concentrating Solar Technologies Dept.
Sandia National Laboratories
Albuquerque, New Mexico

ckho@sandia.gov, (505) 844-2384

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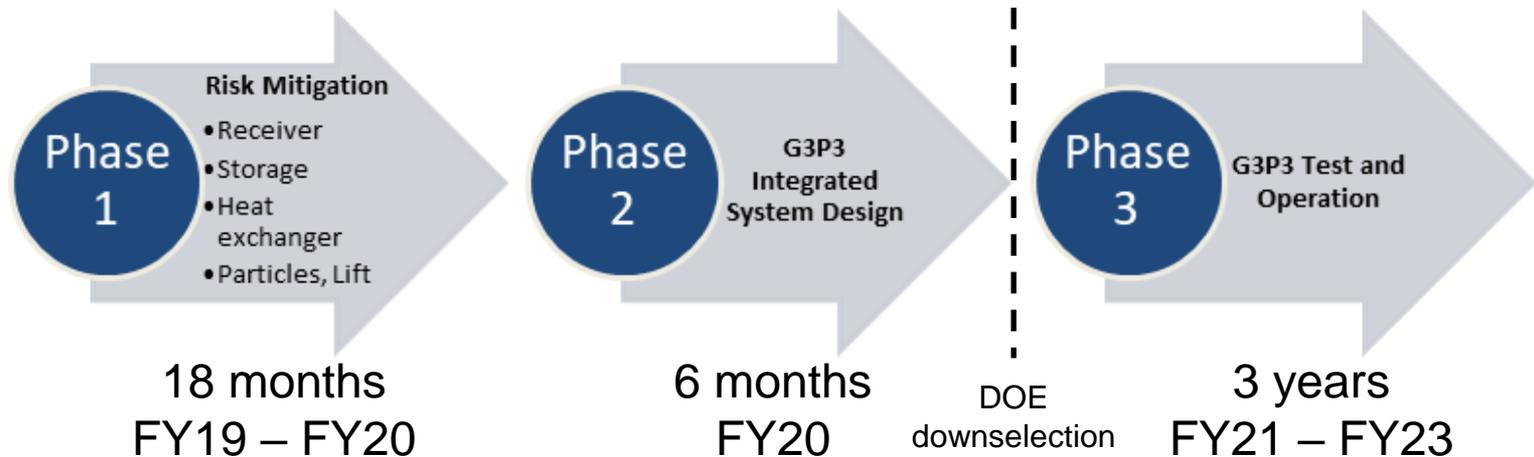


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G3P3 Objectives

- **De-risk, design, construct, and operate** a multi-MW_t particle receiver system
 - Heat working fluid (e.g., sCO₂ or air) to ≥ 700 °C
 - 6 hours of energy storage
 - > 2,000 hours of on-sun operation
 - Meet SunShot cost and performance goals
- **Leverage** international expertise and CSP activity
- Accelerate **commercialization** of G3P3 technology



Value Proposition

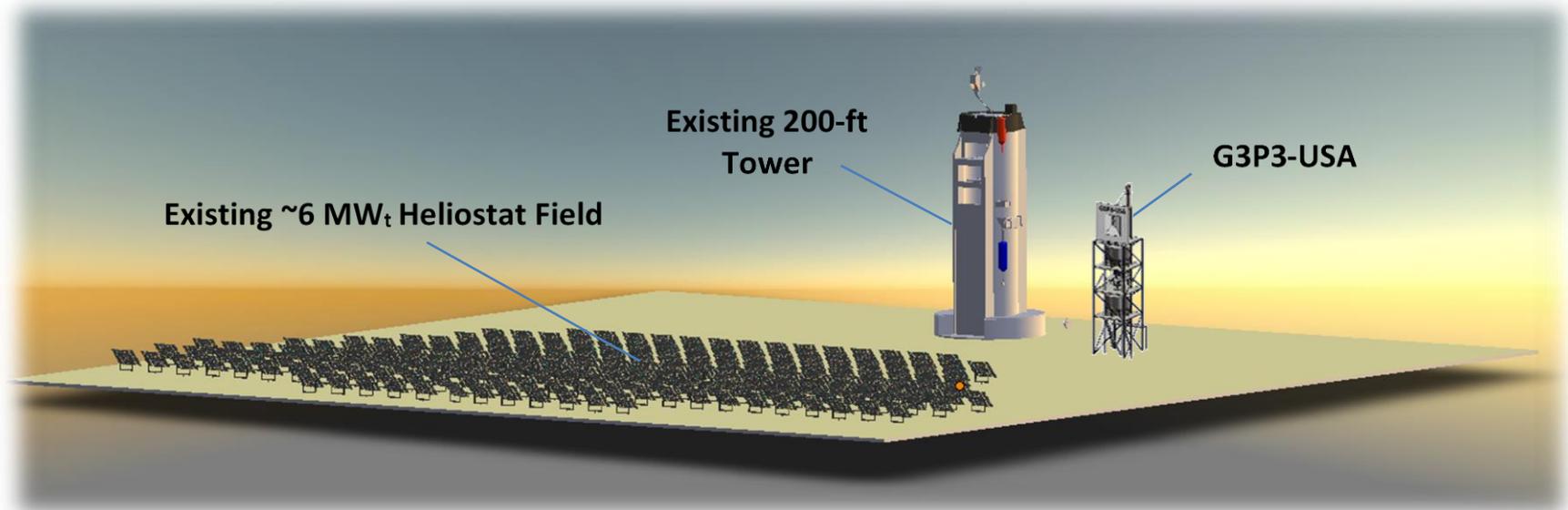
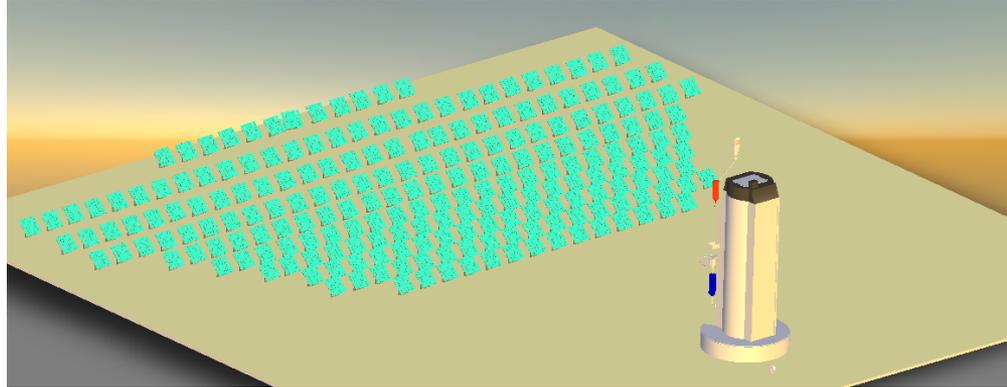
- Proposed particle receiver system has significant advantages over current state-of-the-art CSP systems
 - Sub-zero to over ~ 1000 °C operating temperatures
 - No freezing and need for expensive trace heating
 - Use of inert, non-corrosive, inexpensive materials
 - Direct storage (no need for additional heat exchanger)
 - Direct heating of particles (no flux limitations on tubes)



Gen 3 Particle Pilot Plant (G3P3)

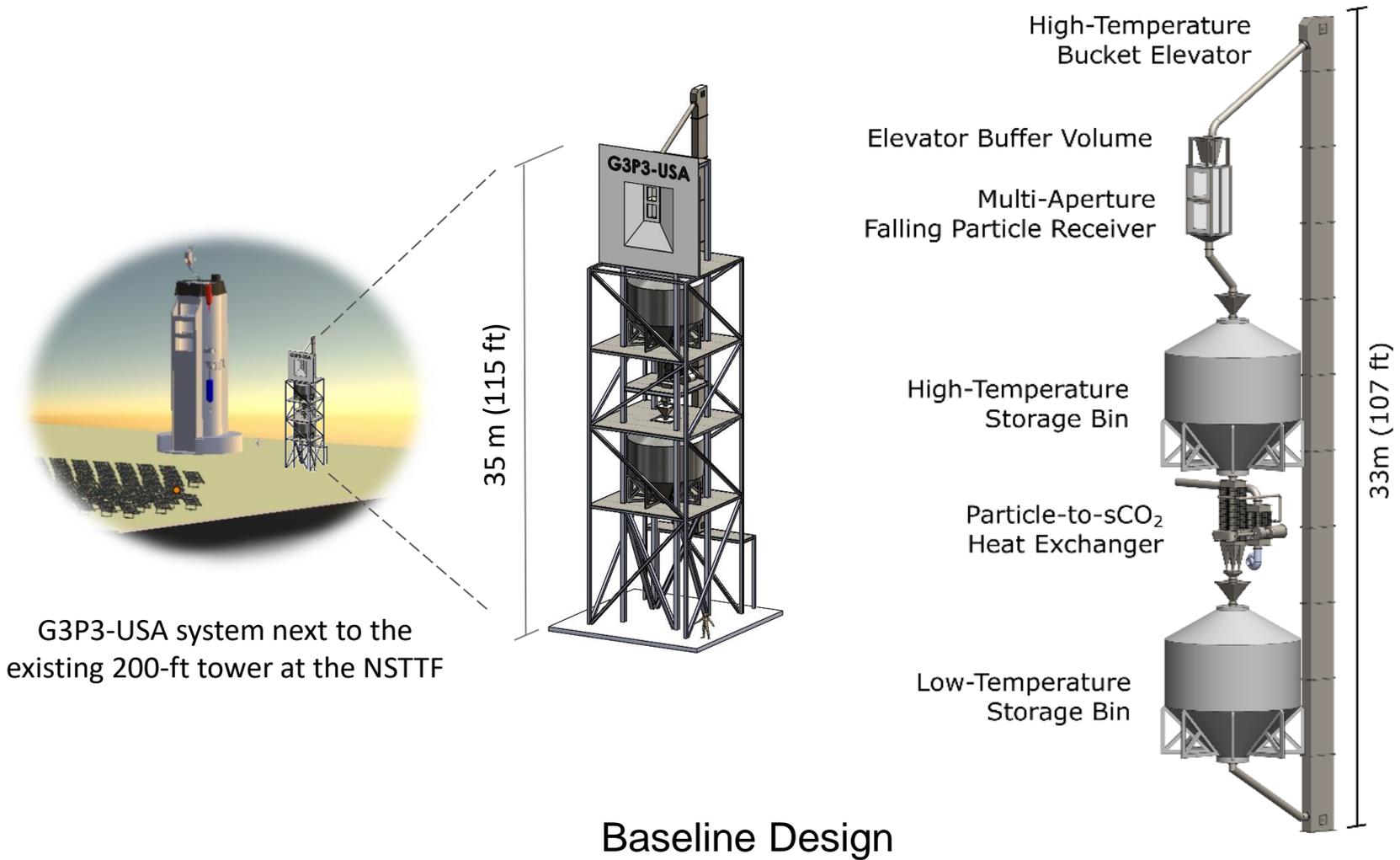
Integrated System

National Solar Thermal Test Facility (NSTTF), Albuquerque, NM



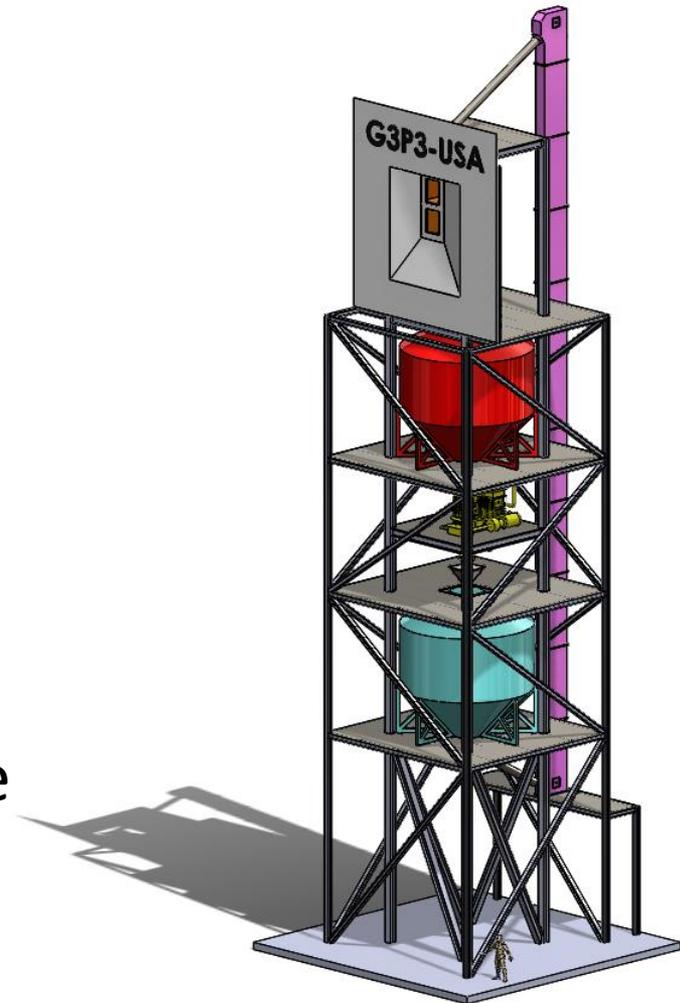
Gen 3 Particle Pilot Plant (G3P3)

Integrated System



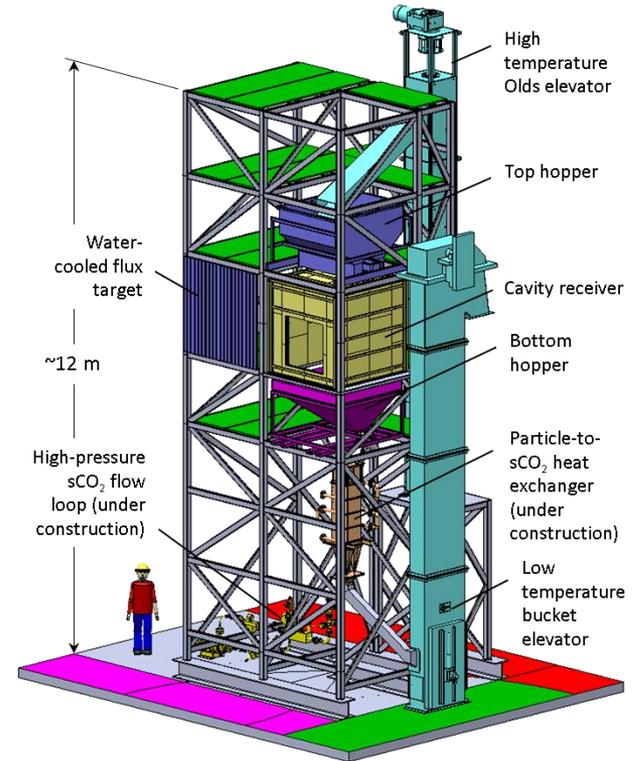
Major Components

- Particles
- Receiver and Feed Bin
- Particle Storage
- Particle Heat Exchanger
- Particle Lift and Conveyance
- Balance of System



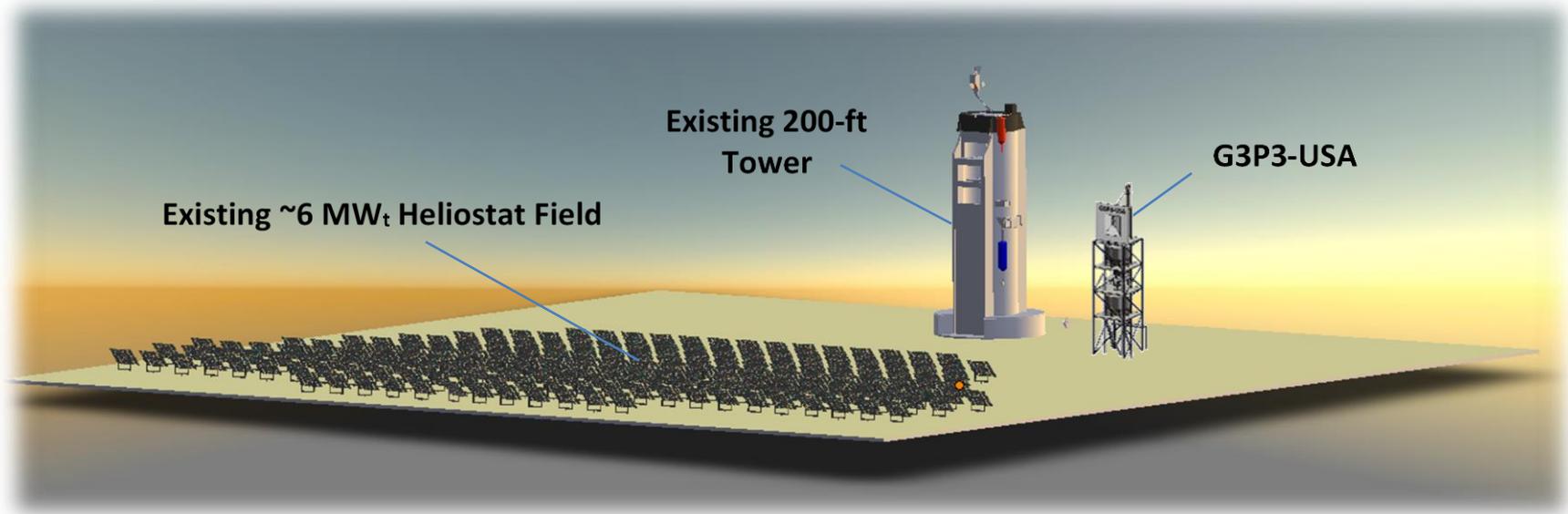
G3P3 Summary

- Significant advantages
 - Direct heating of particles
 - Wide temperature range (sub-zero to $>1000\text{ }^{\circ}\text{C}$)
 - Inexpensive, durable, non-corrosive, inert
 - Demonstrated ability to achieve $>700\text{ }^{\circ}\text{C}$ on-sun with hundreds of hours of operation
- Gaps and risks
 - Particle attrition and wear; dust formation
 - Heat loss (receiver, storage, heat exchanger, lift)
 - Particle-to-working-fluid heat transfer
 - Thermomechanical stresses in heat exchanger and storage tanks
 - Materials erosion



On-sun testing of the falling particle receiver at Sandia National Laboratories

Questions?



Cliff Ho, (505) 844-2384, ckho@sandia.gov