

UAT MS555 Assignment 5

Zombie-Proof Silo

Gold Card

Cost

\$2,000,000 (rough estimate of \$1.3 million, +10% tax estimate, +25% padding)

Schedule

6 months (no individual work item has an incredibly long duration, but there are significant dependencies in play)

Scope

- Create livable condos in a missile silo.
- Create resident sign-up packages.

The Problem

Fill a decommissioned missile silo with nice condo units and entice buyers with an add-on package made up of survival gear.

The Customers

The silo owner, condo buyers, building contractors, construction workers, bulk retailers, and building suppliers.

Assumptions

- The silo is ready for construction. Most decommissioned silos end up flooded and/or full of sediment and debris, not to mention the intentional destruction/disabling that is done to most abandoned military sites by the military. The unknown of clearing out and making usable a silo is many individual projects in it's own right.



WBS Costing Breakout

1. Residential Section

1.1. Condos

1.1.1. Kitchen

1.1.1.1. Appliances

1.1.1.1.1. Materials - \$40,000

Cost estimated based on wholesale kitchen appliance prices for mid-high tier electric ranges, side-by-side refrigerators, built-in microwaves, and dishwashers. Prices rounded up to account for freight shipping.

1.1.1.1.2. Labor - \$15,000

Cost estimated based on an average cost of two laborers working for two days on each unit setting up the appliances in each kitchen. A total of 160 work hours, with a very rough worker rate of \$43/hr based on averages from the internet that factor in different worker levels and insurance/etc. requirements, all rounded up to account for delays or unknowns.

1.1.1.2. Counters

1.1.1.2.1. Materials - \$150,000

Cost estimate is an average of estimates generated from CostToBuild.net, available counter/cabinet costs at home improvement stores, and personal experience, all multiplied by the number of units in the complex.

1.1.1.2.2. Labor - \$40,000

Estimate based estimates to build a site-built home averaged together with rough estimates of a basic kitchen install taking anywhere between 24 and 36 hours to complete.

1.1.1.3. Flooring

1.1.1.3.1. Materials - \$10,000

Estimate based on an average cost of \$4.00/sqft for hardwood flooring plus the cost of \$0.63/sqft for premium underlayment, multiplied by the square footage of the kitchen based on the floorplan (190 sqft) and then by the number of units in the complex. Estimate rounded up to account for waste product.

1.1.1.3.2. Labor - \$7,000

Resources say that on average a crew of two can complete 750-1000 sqft. of hardwood floor installation in a single workday, which would put this estimate much lower than it is. Since there are 10 separate jobs sites, one per unit, I'm

estimating that each single kitchen will take a full workday for that same team even though the total square footage of each kitchen is only 190 sqft. The start-up and tear-down costs of laying flooring will have to be paid for each individual unit.

1.1.1.4. Supplies

1.1.1.4.1. Flatware - \$1,500

Basic, medium-weight stainless steel flatware can cost anywhere from \$1-3 each depending on the type. This estimate is assuming an average cost of \$12.50 per dinner set (teaspoon, dinner spoon, knife, salad fork, & dinner fork), multiplied by 6 residents per unit, multiplied by the number of units.

1.1.1.4.2. Dishes - \$2,000

Estimate is based on 6-person occupancy and 2 of each type of dish per occupant, including plates, bowls, glasses, and mugs. Dishes are fairly cheap when purchased in bulk from restaurant supply companies, and this estimate has been inflated to account for shipping costs and variance in availability.

1.1.1.4.3. Linens - \$1,000

Estimate for kitchen linens includes hand towels, dish towels, washcloths, and cloth napkins. Assuming a fair number of each type of towel per unit. When purchased in bulk, linens are incredibly cheap.

1.1.1.4.4. Utensils - \$1,000

Utensil budget includes, for each unit, a set of all basic preparation and cooking utensils including measuring cups, knives, spatulas, and many other tools. When purchased in bulk each individual element of the kitchen utensil kit can be found for less than \$5 through kitchen supply companies.

1.1.1.4.5. Cookware - \$2,000

Estimated based on a standard package of a full high-quality stainless steel pots/pans set as well as multiple aluminum baking sheets. Prices are rounded up to account for shipping.

1.1.2. Bathrooms

1.1.2.1. Fixtures

1.1.2.1.1. Materials - \$90,000

Estimate based on the cost of a full one-piece shower surround, shower door, and toilet. Cost rounded up to cover fixture availability.

1.1.2.1.2. Labor - \$60,000

Cost estimate based on an average of personal experience having a bathroom remodeled recently and estimates from CostToBuild.net. Estimate

assumes a 2-worker team can complete the full installation of a single bathroom in under 3 days at a rate of \$43/hr.

1.1.2.2. Counters

1.1.2.2.1. Materials - \$30,000

Cost estimate based on the above-average cost of bathroom vanities available at home improvement stores, multiplied by the number of bathrooms and units in the complex.

1.1.2.2.2. Labor - \$6,000

Estimate assumes each bathroom counter installation takes no more than 4 hours for a professional at \$43/hr, multiplied by the number of bathrooms and units in the complex.

1.1.2.3. Flooring

1.1.2.3.1. Materials - \$6,000

Ceramic tiles are incredibly cheap, and each unit only has a total of approximately 160 sqft. of tiled bathroom floor, but we're heavily increasing the estimated cost here in order to account for the additional costs of grout, spacers, waste-tile, and other incidentals.

1.1.2.3.2. Labor - \$10,000

This estimate assumes a single worker can complete the tiling of one bathroom in a single workday. Though each bathroom is fairly small on it's own (50 sqft), the fact that the work area is not rectangular will make cutting and laying tiles much more time-consuming.

1.1.2.4. Supplies

1.1.2.4.1. Linens - \$1,000

Hand and bath towels are extremely cheap when purchased at wholesale prices. This estimate is factoring in 20 hand towels per bathroom per unit as well as 6 full-sized bath towels per bathroom per unit. Prices are based on current bulk purchase prices for hotel-quality linens found online.

1.1.2.4.2. Disposable Supplies - \$12,000

Estimate based on supplying each bathroom in each unit with a moderately long-term supply of toilet tissue, shampoo, conditioner, body wash, and hand soap based on current bulk costs. Prices are rounded up to cover shipping costs, and baseline price is very flexible based on quality of supplies desired with this specific estimate on the high end.

1.1.3. Living Spaces

1.1.3.1. Flooring

1.1.3.1.1. Material - \$12,000

The total carpeted living space per unit that isn't a bedroom is roughly 600 sqft per unit, with an average material cost of \$2/sqft for standard carpet and premium padding.

1.1.3.1.2. Labor - \$7,000

Installation of carpet in the shared spaces of each unit should be very simple for a team of two and should take less than a day to complete. Our estimate is based on a rough average worker cost per day multiplied by the number of units.

1.1.3.2. Furnishings

1.1.3.2.1. Seating - \$20,000

Cost estimated on a baseline of one sofa and two recliners per living room in each unit, multiplied by the number of units in the complex, rounded up to account for shipping costs and variations in selection.

1.1.3.2.2. Dining - \$10,000

Cost estimated based on the rough sample of prices of 6-person dining table sets (\$800), rounded up for shipping costs and the time spent assembling items delivered in multiple pieces.

1.1.3.2.3. Entertainment - \$6,000

Cost estimated based on the current cost of a 4K 55" TV plus the cost of a wall-mounting bracket, multiplied by the number of units in the complex.

1.1.4. Bedrooms

1.1.4.1. Flooring

1.1.4.1.1. Materials - \$12,000

Material cost estimate for the 3 bedrooms in each unit assumes a carpet price of roughly \$1/sqft plus a premium padding cost of another \$1/sqft. The total floor space of all combined bedrooms in a single unit adds up to roughly 550 sqft, which we multiply and round up to cover waste costs during installation.

1.1.4.1.2. Labor - \$7,000

Installing carpet is incredibly quick. A team of two should be able to easily install a full unit's bedroom carpet in a single day, making our estimate as simple as $\$43/\text{hr} \times 8\text{hr} \times 2\text{ workers} \times 10\text{ units}$, rounded up of course.

1.1.4.2. Furnishings

1.1.4.2.1. Beds - \$36,000

Cost calculated based on rough estimates of average mattress and bed

frame cost from multiple wholesale furniture distributors, multiplied by the three bedrooms per unit and by the number of units.

1.1.4.2.2. Dressers - \$20,000

Cost estimated from an average of roughly \$600 allocated per each bedroom in the complex, rounded up to account for shipping costs. Based on wholesale furniture sites, that amount should be able to cover a wide variety of dresser options for our customers.

2. Resident Sign-Up Package

[Assuming 1 bug-out bag per condo unit.]

2.1. Bug-Out Bag

2.1.1. Backpack - \$3000

Quality bug-out bags can easily cost over \$250 each, multiplying that by our number of units and rounding up for shipping costs gets us our estimate.

2.1.2. Survival Gear - \$500

Survival gear is an umbrella category here, taking into account basic needs like fire-starters, first aid, compass, and water purification. Each component piece here is relatively cheap, leading to an estimated \$50 per bug-out bag.

2.1.3. Knife - \$2,000

A quality blade could be the difference between life and death for one of our customers, so we're allotting \$200 per condo unit which should easily cover a high quality fixed-blade hunting knife or hatchet.

2.1.4. Thermal Blanket - \$300

Thermal blankets are cheap individually, usually less than \$10, but we're including multiple in each bug-out bag on the assumption that there could be multiple member's of the resident's family and that the resident may accidentally damage their thermal blanket.

2.1.5. Map - \$1000

Quality, waterproof, rugged maps can cost up to \$50 each, and usually only cover a small section of land in much detail. Each bug-out bag will include appropriate overland maps based on the path of travel between the buyer's home address and the location of the silo.

2.1.6. GPS - \$6000

Small, quality GPS devices can easily cost upwards of \$500. We're including a single one in each bug-out bag to help our customers navigate to the silo.

3. Core Facilities

3.1. Air Conditioning

3.1.1. Materials

3.1.2. Labor

3.2. Air Filtration

3.2.1. Materials - \$15,000

I was unable to find official prices for whole-building commercial/industrial air filtration systems, so this estimate is assuming that the cost of a single shared unit is equal to or less than the cost of one individual unit per level of the silo complex. This estimate is based on the average price of \$1000 per 1800 sq.ft., multiplied by the number of floors in the complex.

3.2.2. Labor - \$10,000

Cost calculated based on a full work-week from both a qualified electrician and HVAC technician.

3.3. Generators

3.3.1. Materials - \$300,000 (solar) + \$30,000 (diesel)

Solar price calculated based on the average panel cost (per Energy Sage) times the total number of panels required to support the yearly demand of 10 apartments of a comparable size to the silo's condos, plus a hefty increase to account for fluctuations in demand, shared facility energy use, and environmental factors. Diesel generator pricing is based on the average cost of high-kW industrial standby generators capable of matching the ideal output of the solar power system.

3.3.2. Labor - \$30,000

Calculated from the median Home Advisor estimate of \$75/hr for a qualified electrician, multiplied by 5 electrician each working an average of two weeks (80 hrs). This may be higher than necessary, but since we're installing both solar panels and diesel generators, there is a lot of ground to cover by the electricians.

3.4. Hydroponic Farm

3.4.1. Materials - \$35,000

Calculated based on combined price of a pre-fabricated 32 bin, 4 site deep-water culture hydroponics system plus adequate water chiller and a sizable amount of deep-water hydroponics nutrients. Price also includes enough high-performance LED UV grow lights to cover the entire square footage of the hydroponic system. Prices sourced from Hydro Builder, a website that sells a wide range of hydroponic gardening systems and accessories.

3.4.2. Labor - \$8,000

Calculated assuming a single qualified plumber working up to a full week to setup the plumbing of the hydroponic system, plus 1-2 workers transplanting crops.

3.4.3. Plants - \$400

Calculated based on the expected 128 planting sites of the DWC hydroponic

system, multiplied by the rough average cost of a flat of vegetable transplants as well as accounting for the differences between plants that come in 12-plant and 24-plant flats. Price padded and rounded up to account for shipping and for over-ordering on the assumption that not 100% of the plants will survive transport.

3.5. Aquaculture Farm

3.5.1. Materials - \$15,000

Roughly calculated from the combined cost of multiple polypropylene aquaculture tanks, aerators for each tank, a shared high-quality inline water heater, multiple filters, and assorted tubing and equipment. Prices sourced from Global Aquaculture Supply and liberally rounded up to account for tax, shipping, etc.

3.5.2. Labor - \$10,000

Calculated assuming two qualified, licensed, and bonded plumbers working a full 40 hour week at a rate of \$100/hr based on Home Advisor plumber estimates. Rounded up and padded out to account for any overages and plumbing supplies required.

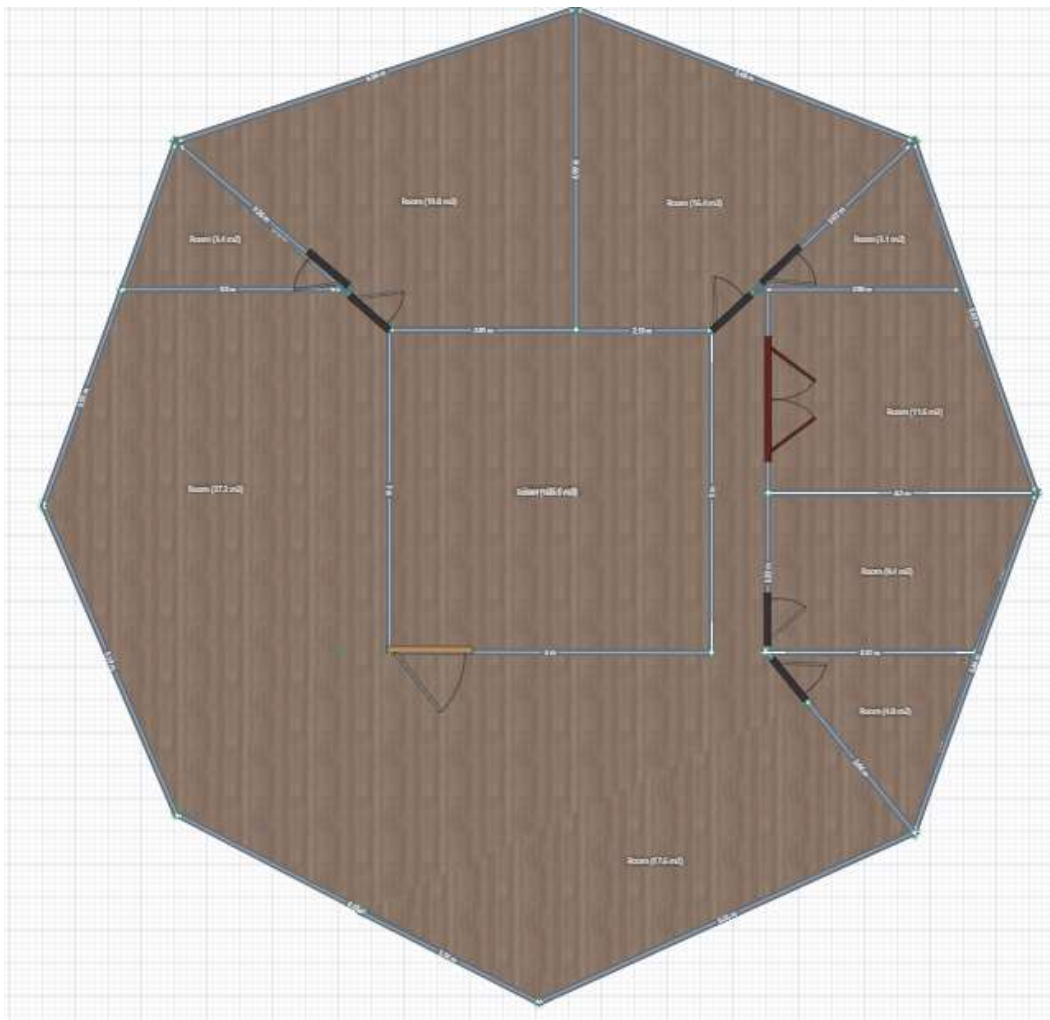
3.5.3. Fish - \$2,500

Calculated assuming two tilapia breeding colonies per aquaculture tank, plus adequate food for months. Prices sourced from Tilapia Depot, a wholesale distributor of tilapia for breeding. This number of breeding-age tilapia should be able to jump-start the aquaculture cycle in the silo.

Condo Floorplan

This is an extremely rough floorplan based on the 55' diameter of a Titan II missile silo's main chamber, allotting a 16'x16' center column for an elevator, stairwell, and landings outside each unit. Each unit as designed has roughly 1400 sq.ft. of floor space divided into three bedrooms, three bathrooms, an office, large kitchen, and living areas. This same space could easily be divided into two 1-2 bedroom units, or three studio units, without changing the overall price tag by an appreciable amount.

10 of these 3-bedroom units would be sandwiched in the nearly 150' deep silo, leaving space for five floors of shared and utility space (general store, exercise and entertainment rooms, and the aquaculture and hydroponic farms).



References

- Bedroom Size. (n.d.). Retrieved June 15, 2020, from House Plans Helper website: <https://www.houseplanshelper.com/bedroom-size.html>
- Calculating base labor rates for a construction crew | norbord - north American products. (2019, September 22). Retrieved June 15, 2020, from Norbord - North American Products website: <https://www.norbord.com/na/blog/calculating-base-labor-rates-for-a-construction-crew>
- Custom made ladders & platforms | fixed & rolling ladders. (n.d.). Retrieved from <https://www.platformsandladders.com/industrial-stairways>
- Electric Generators Direct. (n.d.). Retrieved from <https://www.electricgeneratorsdirect.com/>
- Electricity Usage Calculator | Estimate your kWh energy usage | ComparePower. (2018, September 28). Retrieved June 15, 2020, from ComparePower website: <https://comparepower.com/kwh-electricity-energy-usage-calculator/>
- Free 3D home planner | design a house online: Planner5D. (n.d.). Retrieved June 15, 2020, from Planner5d.com website: <https://planner5d.com/>
- Global Aquaculture Supply Co. (n.d.). Retrieved from <https://globalaquaculturesupply.com/>
- Hardwood Flooring Installation - how long does this take? - Nufloors Canada. (2018, May 16). Retrieved June 15, 2020, from Nufloors Canada website: <http://nufloors.ca/blog/hardwood-flooring-installation-how-long-does-this-take>
- HomeAdvisor. (n.d.). Retrieved from <https://www.homeadvisor.com/>
- Hotel & motel supplies | shop online at national hospitality supply. (n.d.). Retrieved June 15, 2020, from Nathosp.com website: <https://www.nathosp.com/>
- House cost estimator | cost to build a home. (n.d.). Retrieved June 15, 2020, from Costtobuild.net website: <https://costtobuild.net/calculator.html>
- How long does it take to install kitchen cabinets? - Singapore kitchen cabinet. (2019, November 11). Retrieved June 15, 2020, from Singapore Kitchen Cabinet website: <https://www.kitchencabinets.com.sg/blog/how-long-does-it-take-to-install-kitchen-cabinet.html>
- Hydrobuilder.Com hydroponics supplies & grow lights. (n.d.). Retrieved from <https://hydrobuilder.com/>
- Matasci, S. (2020, March 2). Solar panel cost in 2020 [state by state data] | EnergySage. Retrieved June 15, 2020, from Solar News website: <https://news.energysage.com/how-much-does-the-average-solar-panel-installation-cost-in-the-u-s>
- Passenger Inground - NationwideLifts. (n.d.). Retrieved June 15, 2020, from NationwideLifts website: <https://www.elevators.com/specs/passenger-inground/>
- TilapiaDepot. (n.d.). Tilapia depot | fingerlings, colonies, & feed delivered fresh to you. Retrieved June 15, 2020, from TilapiaDepot website: <https://tilapiadepot.com/>
- titan missile silo. (n.d.). Retrieved June 15, 2020, from Polarinertia.com website: <http://polarinertia.com/jan04/titan01.htm>
- Wholesale bed linens | wholesale towels | direct textile store. (n.d.). Retrieved June 15, 2020, from Direct Textile Store website: <https://directtextilestore.com/>

O'Connor, Jake

- Wholesale cleaning supplies & bulk janitorial supply products. (n.d.). Retrieved June 15, 2020, from Cleanitsupply.com website: <https://www.cleanitsupply.com/>