Acceleration / Deceleration

How do you load such tremendous amounts of materials into an SDVEML system? What's more, what do you do with them at the end station? As one of my reviewers pointed out, the initial vision is of "miners furiously adding rock to a high speed monster, and rock being shot out like a bullet over helpless Orleanders".

In actuality, the logistics of loading and unloading are more benign, albeit more complex.

Imagine the loading station being similar to a highway on-ramp. On the on-ramp, you accelerate to the speed limit, so that when you reach the highway proper, you're at a speed equivalent to the rest of the traffic flow.

Let's assume that the acceleration of the proposed system is fairly gentle – say 3 m/s^2, or about 1/3 g. In order to reach the main-pipeline speed of 900 m/s, we need 301 seconds of acceleration, resulting in an on-ramp of about 62 miles. In other words, it takes 62 miles to speed up, and 62 miles to slow down.

But materials can't speed up or slow down in the main pipeline, or else the full-speed materials behind it would crash into it. So if the main pipeline is running at full speed, there have to be several on-ramps feeding into it running at lower velocities.

The ideal solution is to have a network of on-ramps branching off, ten times, until we have 512 (or 2^10) loading stations. The goal of each loading station is to accelerate a chain of material transport units to the network velocity of 900 m/s.

Branch #	# of chains	V needed, m/s
1	1	1.7578125
2	2	3.515625
3	4	7.03125
4	8	14.0625
5	16	28.125
6	32	56.25
7	64	112.5
8	128	225
9	256	450
10	512	900

A new chain needs to be launches so that it enters the main pipeline almost precisely after the previous chain has passed. If we assume a chain of 64 units, each 5 m long, that means each chain is 320 meters long, and will be "gone" in

0.355 seconds. So every 0.355 seconds, a new chain needs to be launched. If we have 512 launching ramps, that means that at each ramp, a new chain needs to be ready to launch in 0.355 * 512, or 214 seconds (every 3.57 minutes).

As each chain accelerates, it merges into a larger branch of the tree; the chain immediately behind it attaches magnetically, resulting in a longer, composite chain. This merging repeats ten times, resulting in an essentially uninterrupted chain, traveling at 900 m/s.

As the end station approaches, the process is reversed. Full-speed chains are split up into separate off-ramps, eventually ending up with 512 unloading stations, each to be unloaded within 3.5 minutes to prepare for the next batch. This would be a chiefly automated system, and if there are unloading problems, the entire system can be slowed down or even temporarily stopped; the high volume of transport means that downtimes are more affordable.

Note on the figure the unusual cloverleaf appearance of some of the merging stations. These circular branches are designed to minimize the acceleration length while maintaining reasonable centripetal forces.

Loading / Unloading

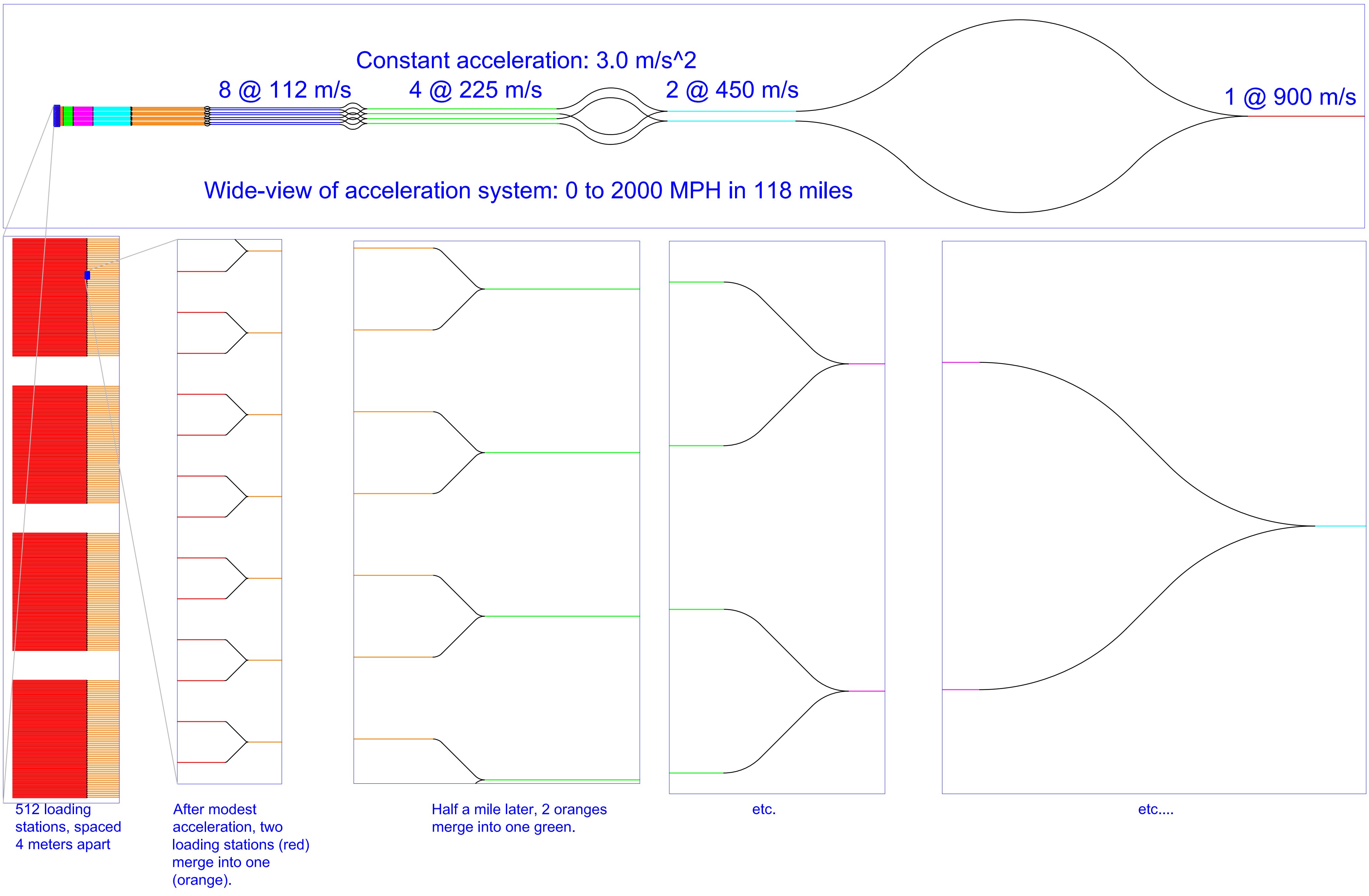
Now, to the loading procedure itself; per the calculations above, we have about 3.5 minutes to prepare a new, 320-meter batch of pre-filled material transport units. That means that during the loading stage, the units must travel at a modest 1.5 meters per second (3.3 miles per hour).

Upstream of this on-deck circle, we have a 3.5 minute timespan in which empty canisters are opened (30 seconds), filled from pre-loaded hoppers (60 seconds), allowed to settle (60 seconds), re-filled to minimize air gaps (30 seconds), closed (30 seconds) and introduced into the “on-deck” chain. The process is continuous, but by no means frantic.

The pre-loaded hoppers are designed to fill several hoppers in parallel at once. Hoppers are fed from aggregate surge piles, as is typical in mining operations, although at a greater magnitude than existing facilities.

The entire 512-branch loading / unloading system will require a facility approximately 1 km wide by 10 km long, although it can be broken into shorter segments if needed.

Note that these 1 km by 10 km facilities are only needed for critical material pathways (water loading, water unloading, rock loading, rock unloading, empty canister loading, empty canister unloading) within the Superior – Colorado – New Orleans triangle. Branch lines will not require a continuous flow of materials, so often a single on-ramp (as opposed to 512) is sufficient.


Constant acceleration: 3.0 m/s^2
8 @ 112 m/s
4 @ 225 m/s
2 @ 450 m/s
1 @ 900 m/s
Wide-view of acceleration system: 0 to 2000 MPH in 118 miles
512 loading stations, spaced 4 meters apart
After modest acceleration, two loading stations (red) merge into one (orange).
Half a mile later, 2 oranges merge into one green.
etc.
etc....