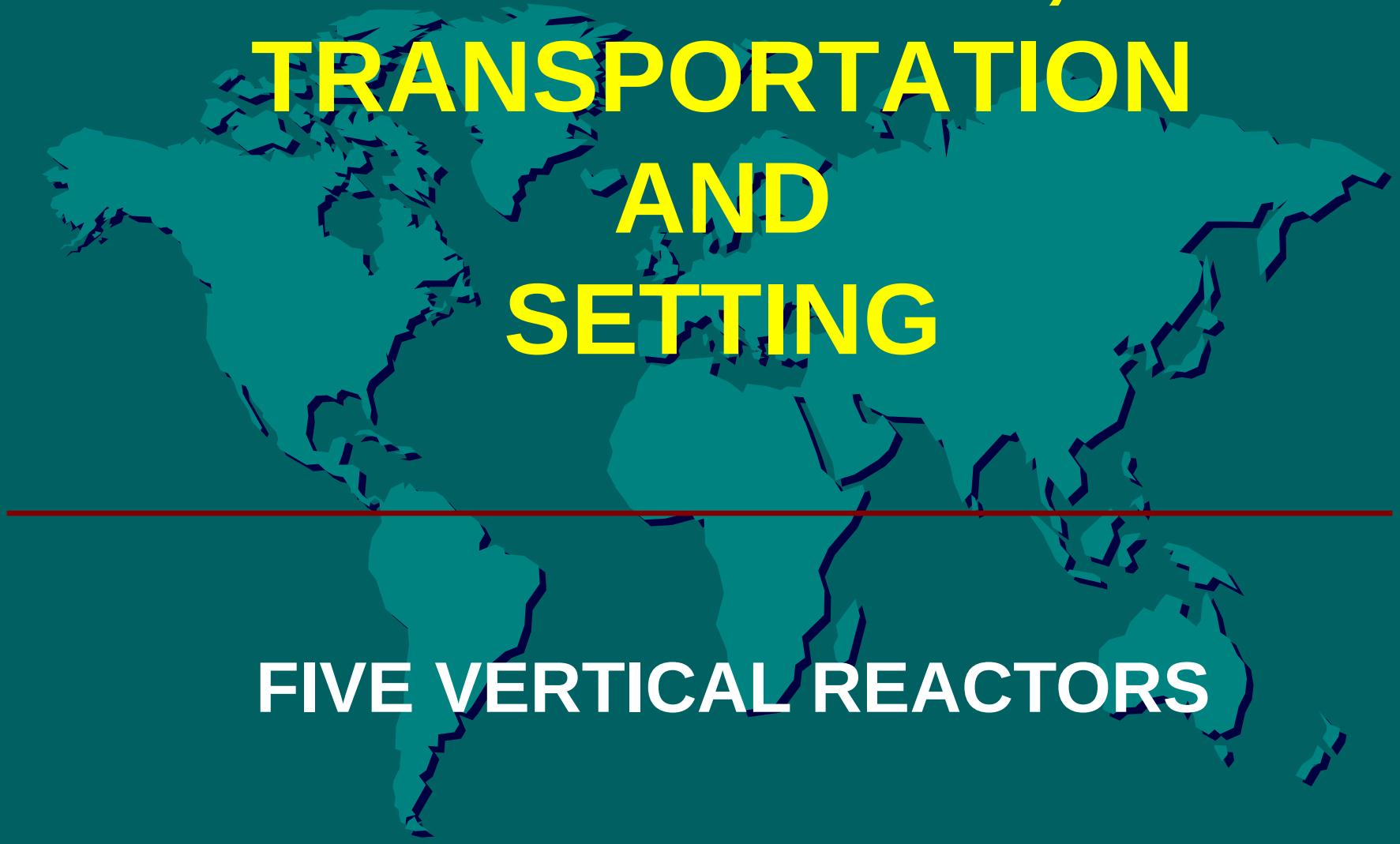
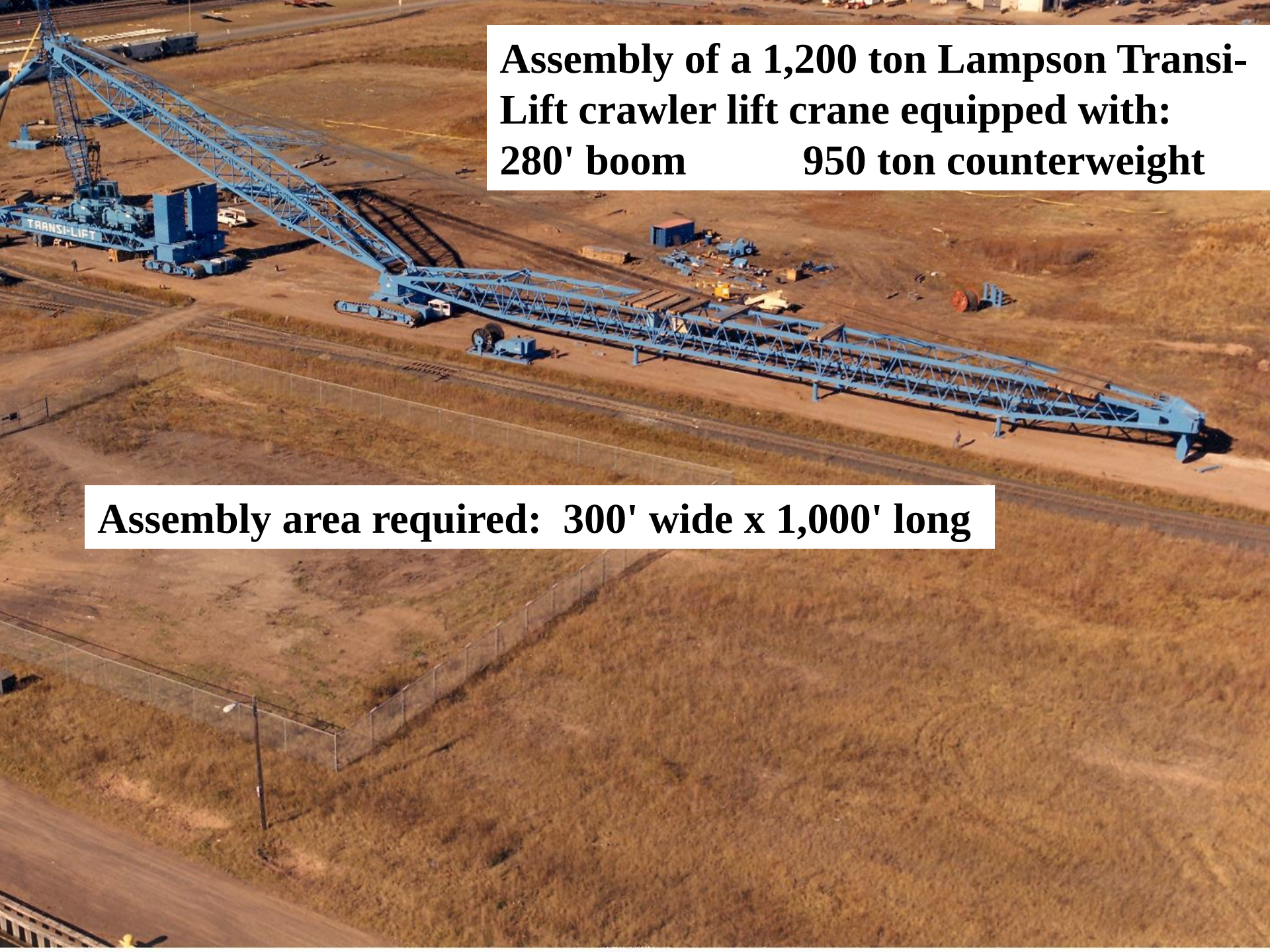
OFFLOADING, TRANSPORTATION AND SETTING



FIVE VERTICAL REACTORS

PORT OF DULUTH

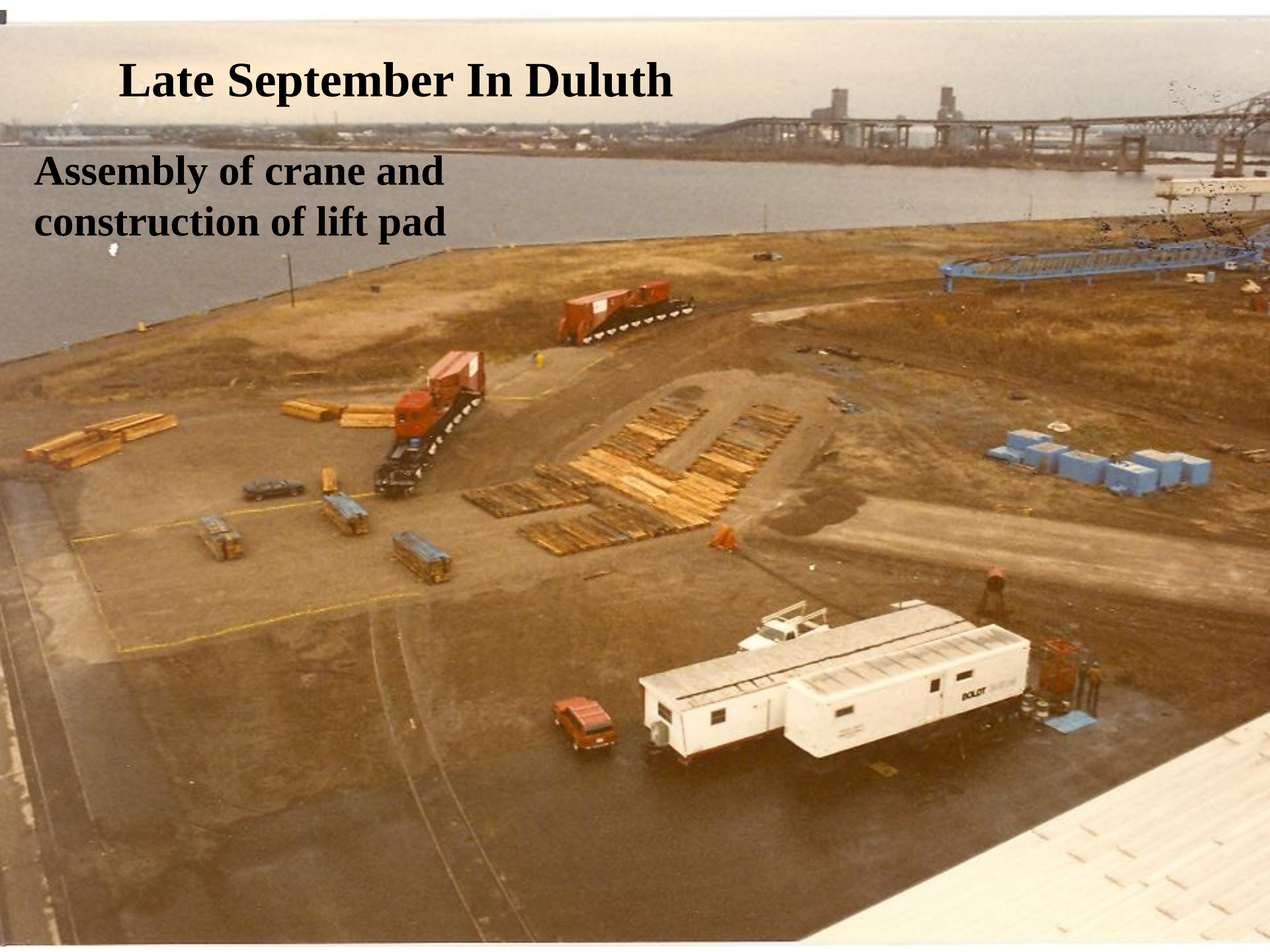


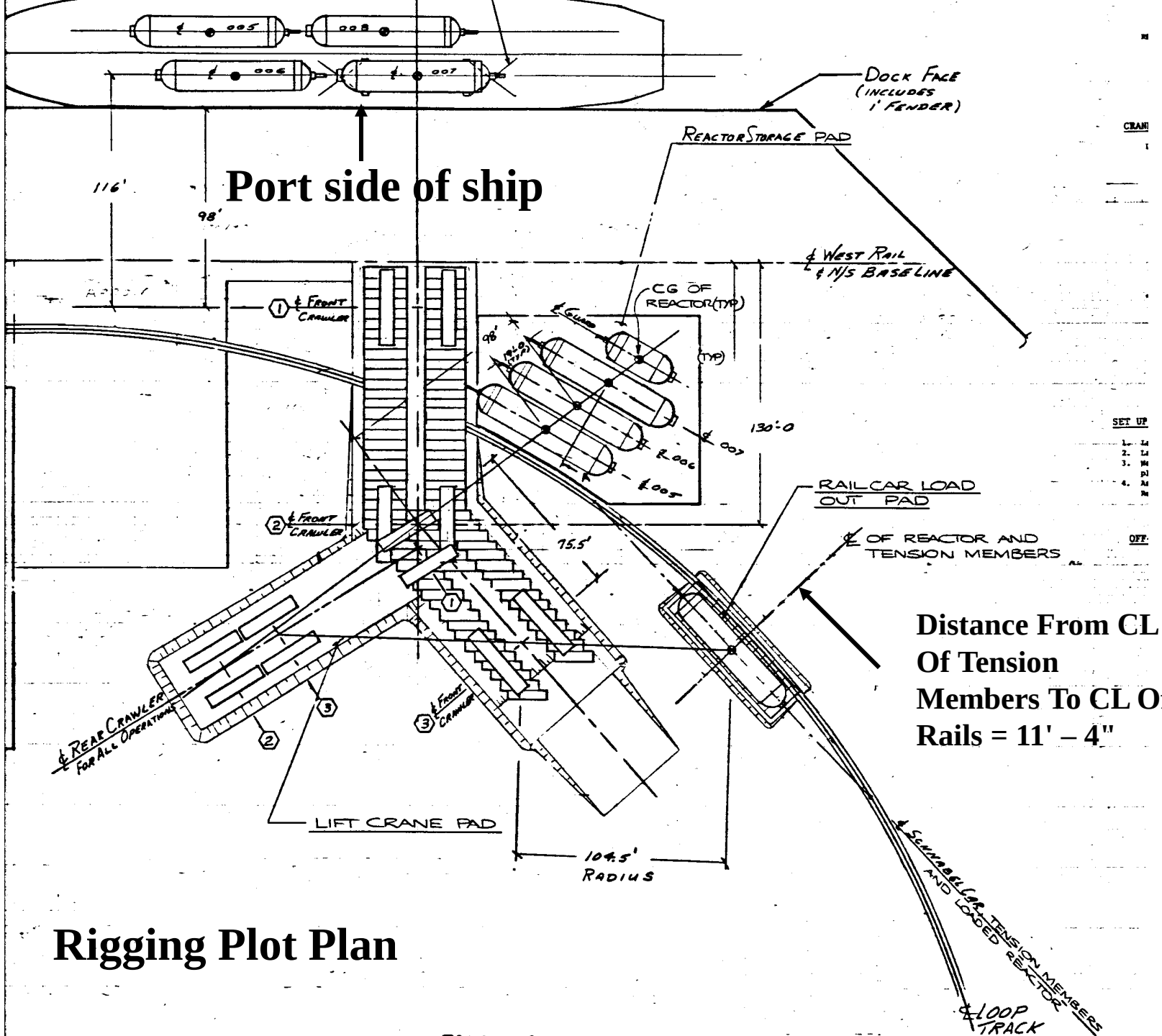
Assembly of a 1,200 ton Lampson Transi-Lift crawler lift crane equipped with:
280' boom 950 ton counterweight

Assembly area required: 300' wide x 1,000' long

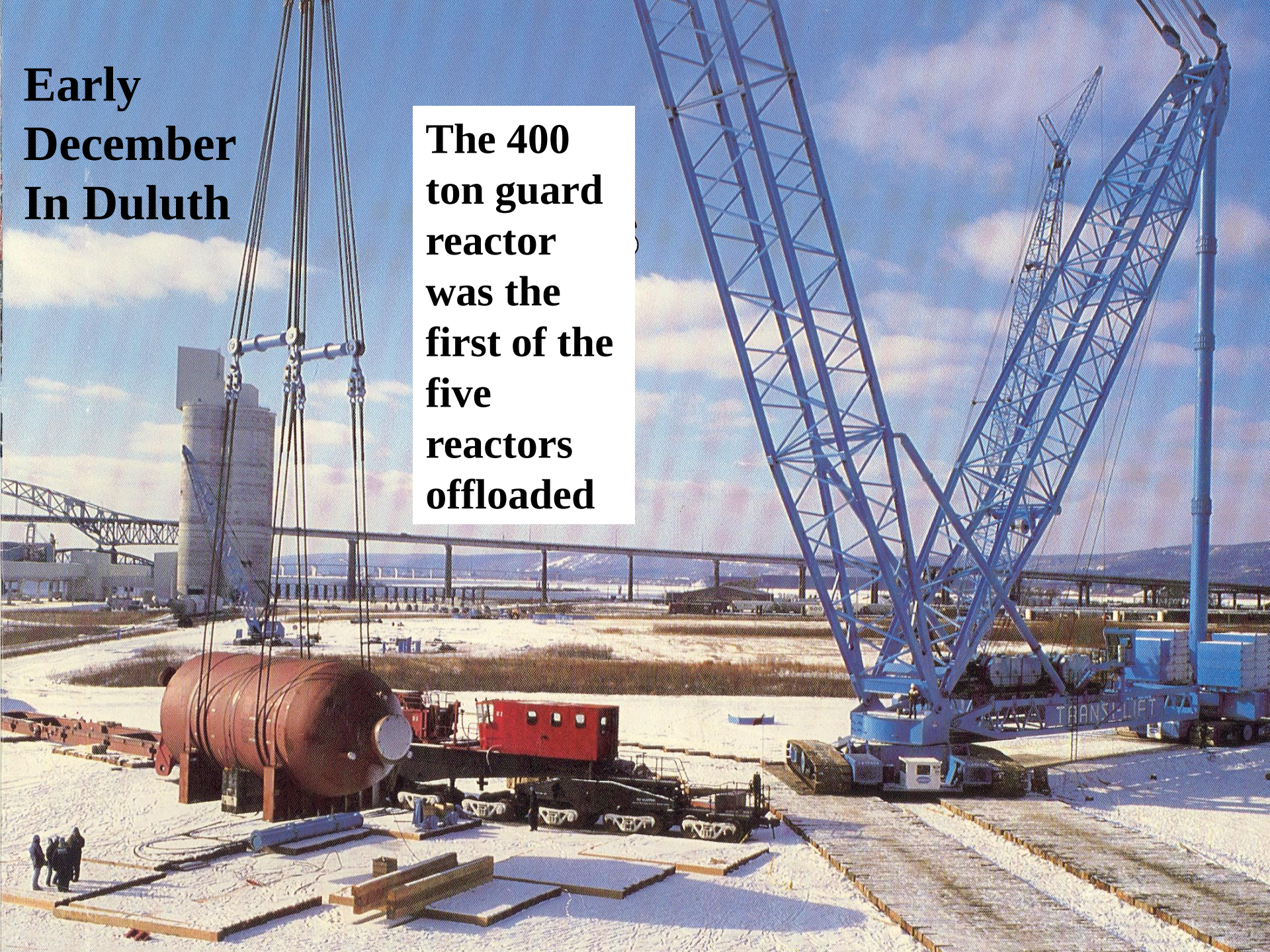
Late September In Duluth

Assembly of crane and construction of lift pad

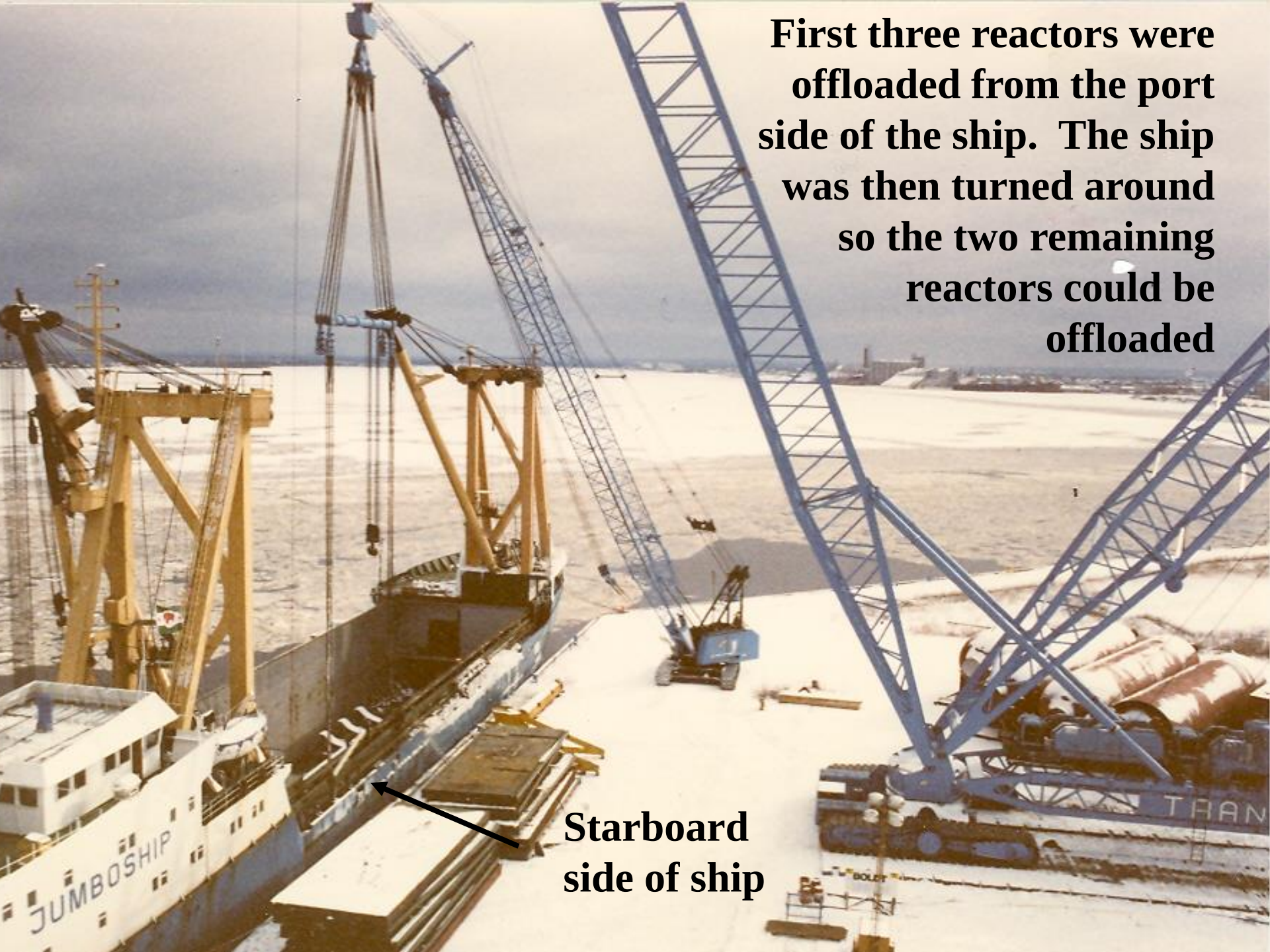



Port side of ship
DOCK FACE (INCLUDES 1' FENDER)
REACTOR STORAGE PAD
116'
98'
℄ WEST RAIL & N/S BASE LINE
CG OF REACTOR (TYP)
℄ GUIDE
(TYP)
130'-0
℄ 007
℄ 006
℄ 005
RAIL CAR LOAD OUT PAD
℄ OF REACTOR AND TENSION MEMBERS
75.5'
℄ REAR CRAWLER FOR ALL OPERATIONS
LIFT CRANE PAD
104.5' RADIUS
℄ SERVICE CAR AND LOADED TENSION MEMBERS
℄ LOOP TRACK
Distance From CL Of Tension Members To CL Of Rails = 11' – 4"
Rigging Plot Plan

Early December In Duluth



The 400 ton guard reactor was the first of the five reactors offloaded

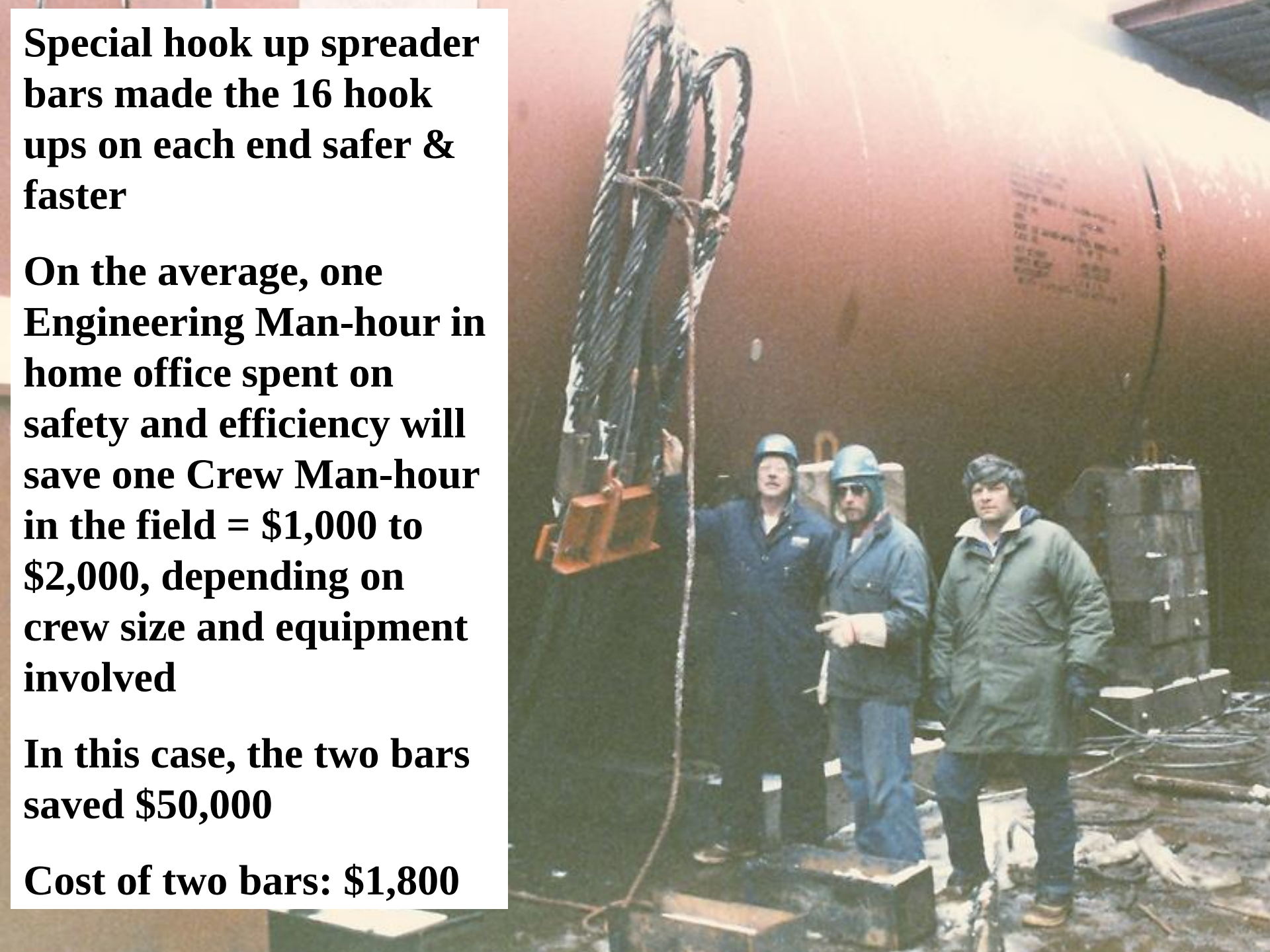

First three reactors were offloaded from the port side of the ship. The ship was then turned around so the two remaining reactors could be offloaded
Starboard side of ship
JUMBOSHIP

Special hook up spreader bars made the 16 hook ups on each end safer & faster

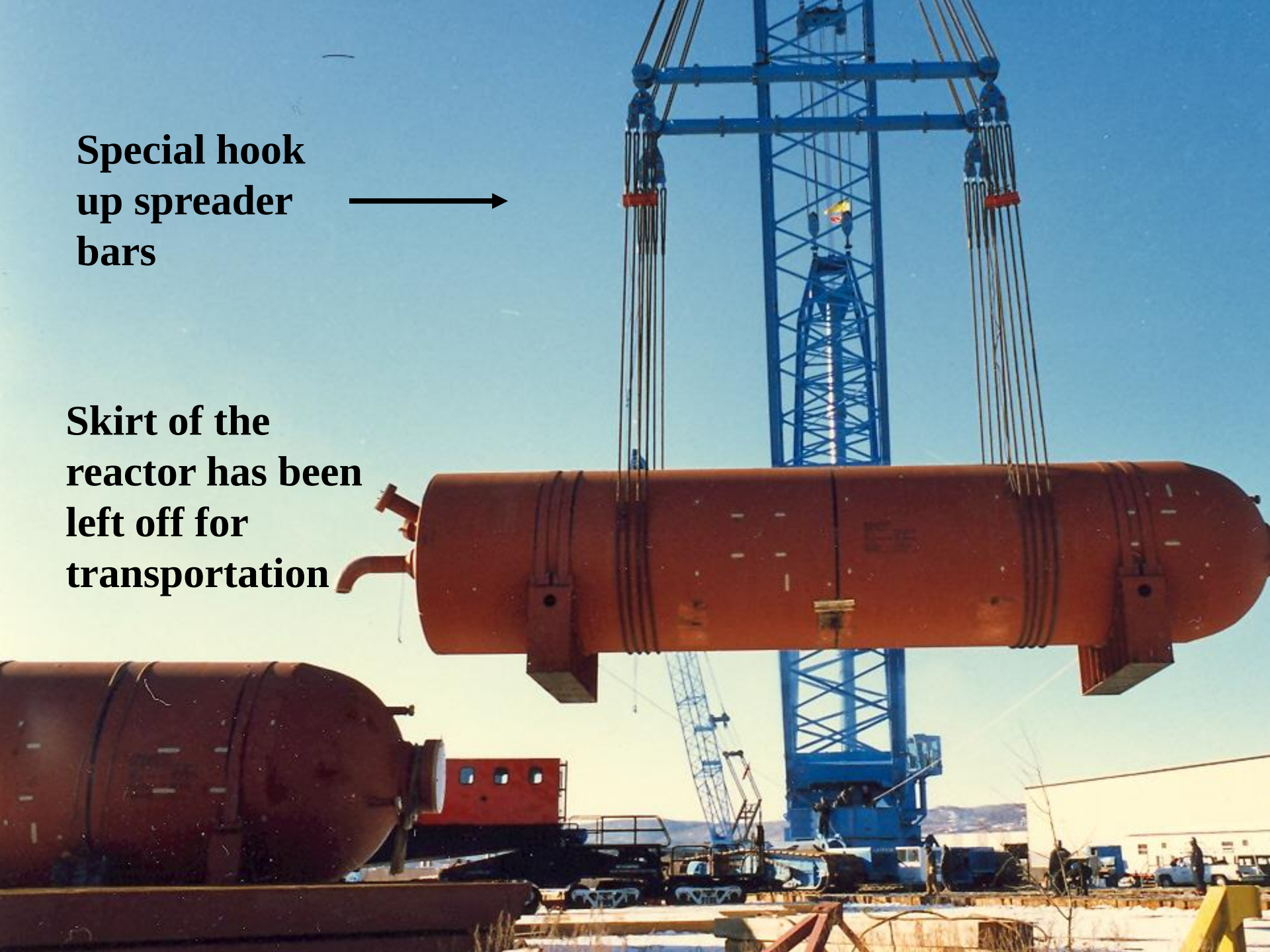
On the average, one Engineering Man-hour in home office spent on safety and efficiency will save one Crew Man-hour in the field = $1,000 to $2,000, depending on crew size and equipment involved

In this case, the two bars saved $50,000

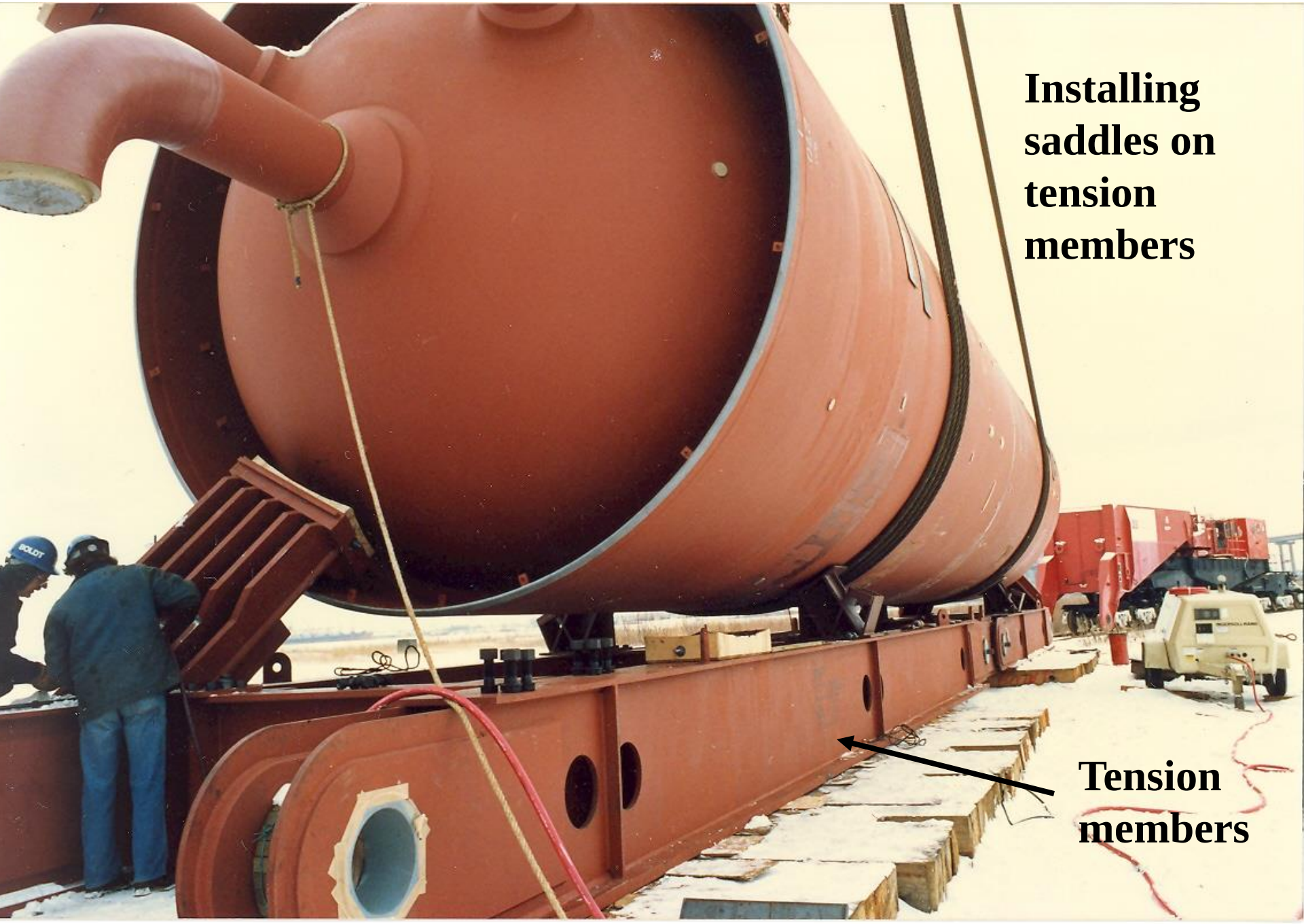
Cost of two bars: $1,800



Using the special spreader bar to hook up the four slings


Special hook up spreader bars
Skirt of the reactor has been left off for transportation


Fifth reactor placed
on tension members
TRANSI-LIFT


Installing saddles on tension members
Tension members

SCHNABEL CAR

CAPACITY: 880 tons, Reactor wt. 790 tons

No. Axles: 36 axles, 18 each half of the car

Axle Load: 66,800 Lbs.

Allow. Load: 67,000 Lbs. on frozen rail bed

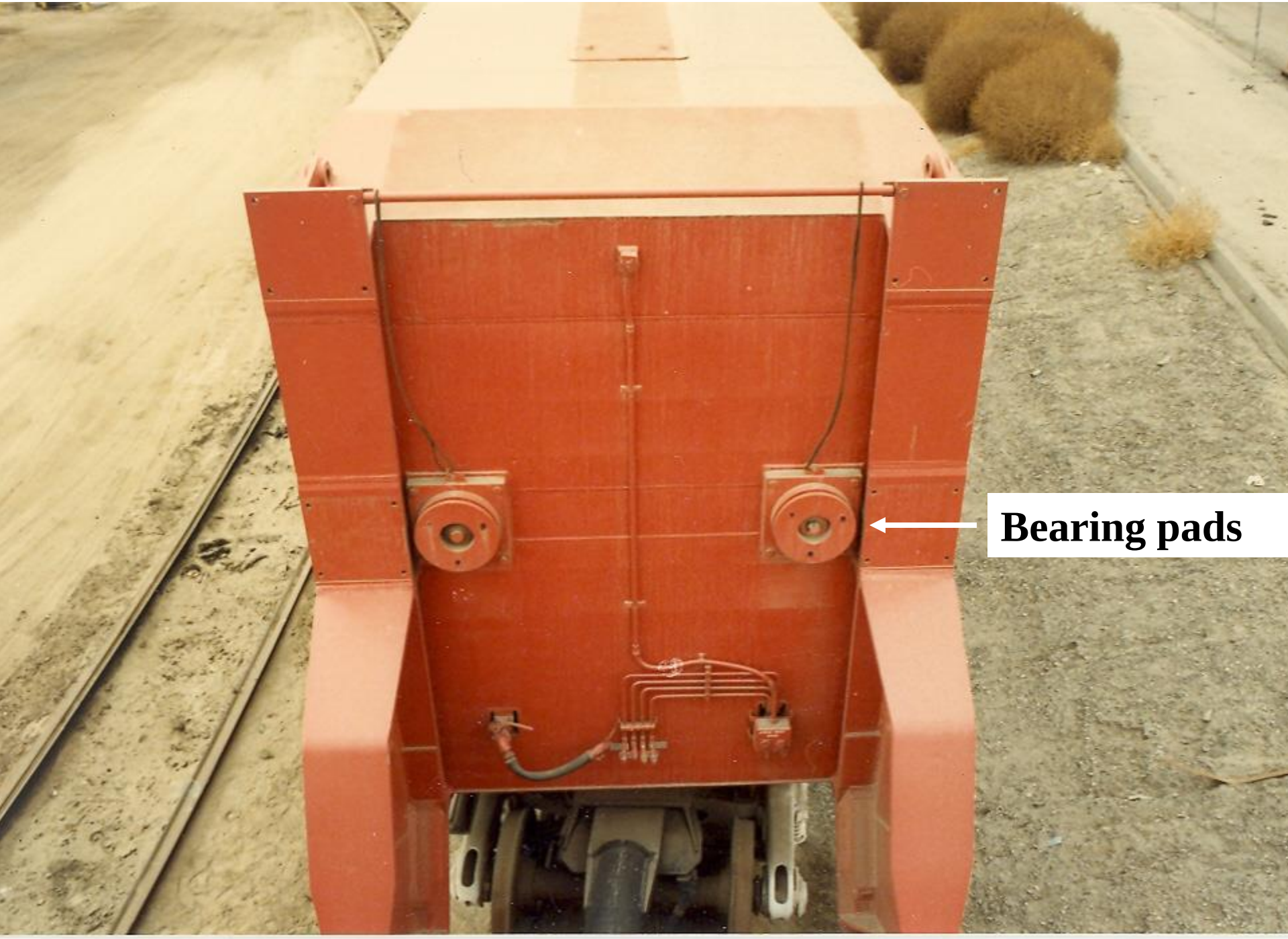
TIME: Three weeks for round trip, from Duluth to Regina, Canada

COST: $1,000,000 per round trip,
$5,000,000 for five reactors
$2,000,000 lump sum railroad upgrades

DEFINITION OF A SCHNABEL HITCH

A Schnabel hitch is defined as one where the load itself is used as a compression and tension member for support during transportation. Usually two lugs welded near the bottom of each end of the load are designed to carry the tension and two bearing pads welded near the top of each end transmit the compression load.

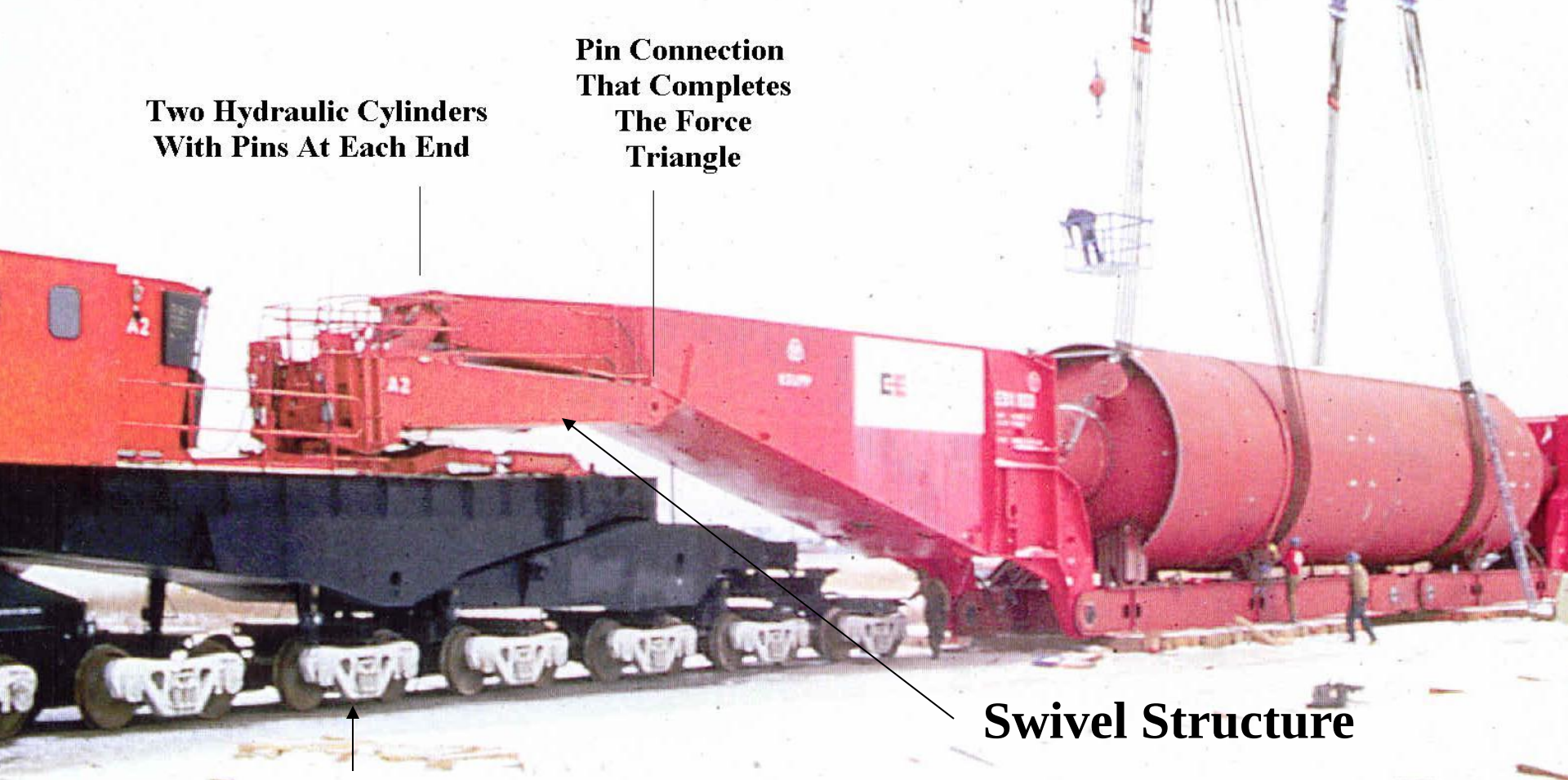
For this move, tension members supported the reactors and were designed for a tension load of 3,000,000 lbs. Heavy wall compression pipes were positioned between the bearing pads of the schnabel car halves and the reactor heads. They were designed for 3,000,000 lbs of compression. The next slide shows the bearing pads of the main load carrying structure.

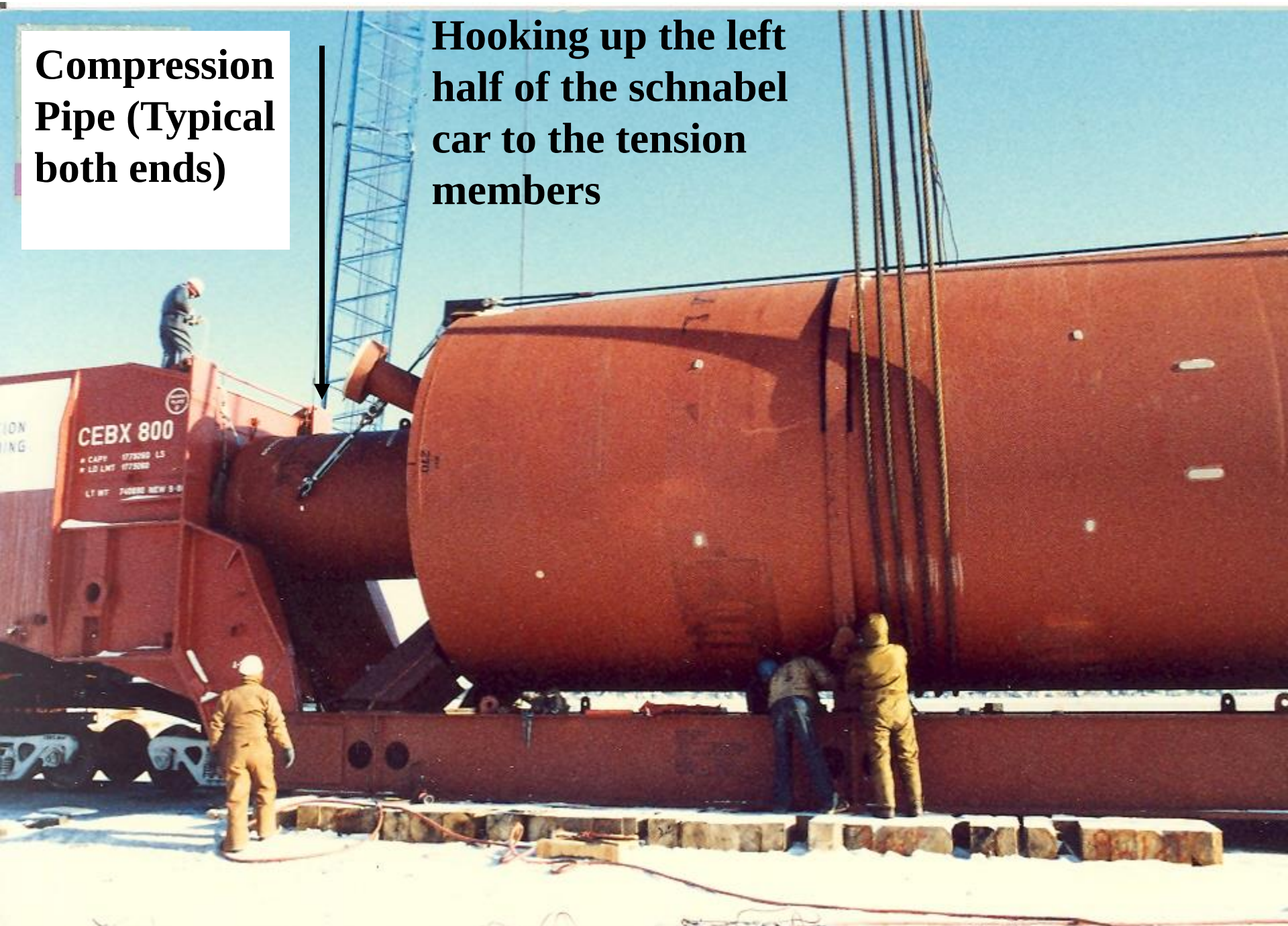

Bearing pads

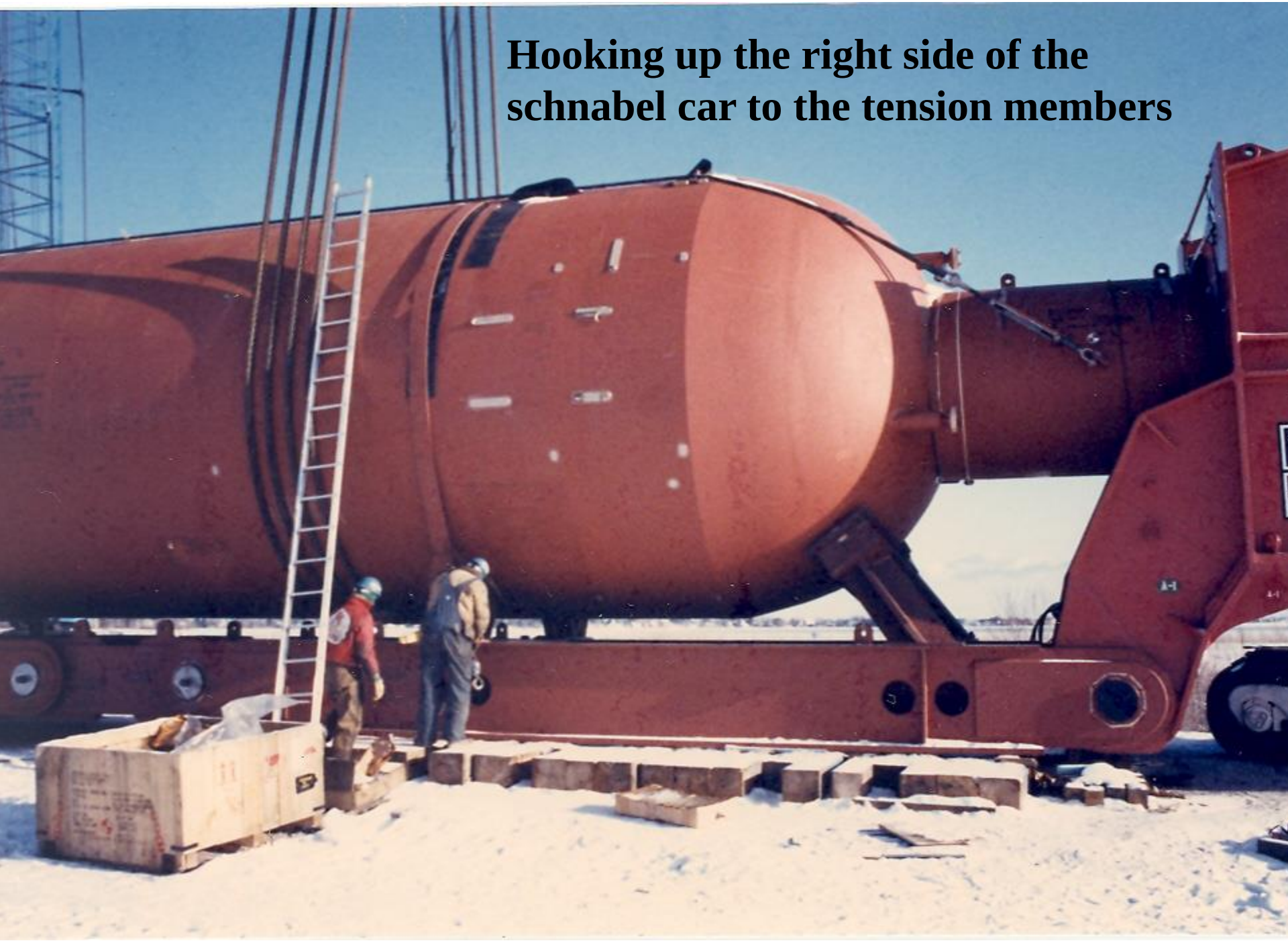
PRINCIPAL OF OPERATION

Each half of the schnabel car is made up of a force triangle, i.e., two 12" hydraulic cylinders that pin to the swivel structure and the main load carrying structure. The inboard end of the swivel structure is also pinned to the main load carrying structure. The schnabel car is ready for lifting when the reactor is resting on the tension members that are pinned to each half of the schnabel car and when the heavy wall compression pipes are bearing on the heads of the reactor and the bearing pads of the main load carrying structure. See next slide.

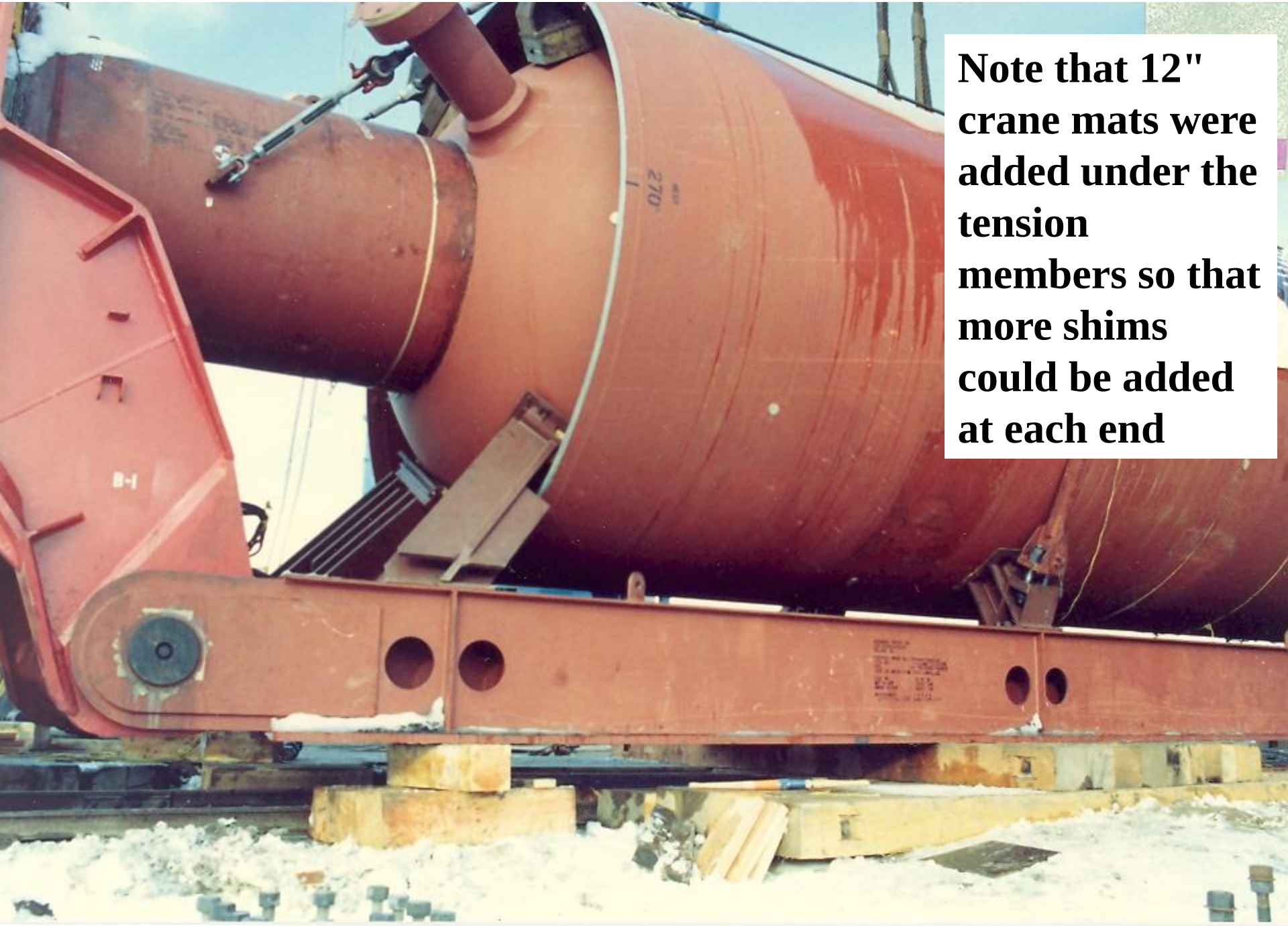
As the four 12" hydraulic cylinders, two on each end, are extended, the gap between the compression pipes and the bearing pads begins to close up. When the gap is completely gone and the compression down thru the center of the reactor reaches 3,000,000 lbs and the tension in the tension members reaches 3,000,000 lbs, the reactor starts to raise vertically above the rails (ATR). The clearance can be adjusted up to 36" by adding more shims at the bearing pads.

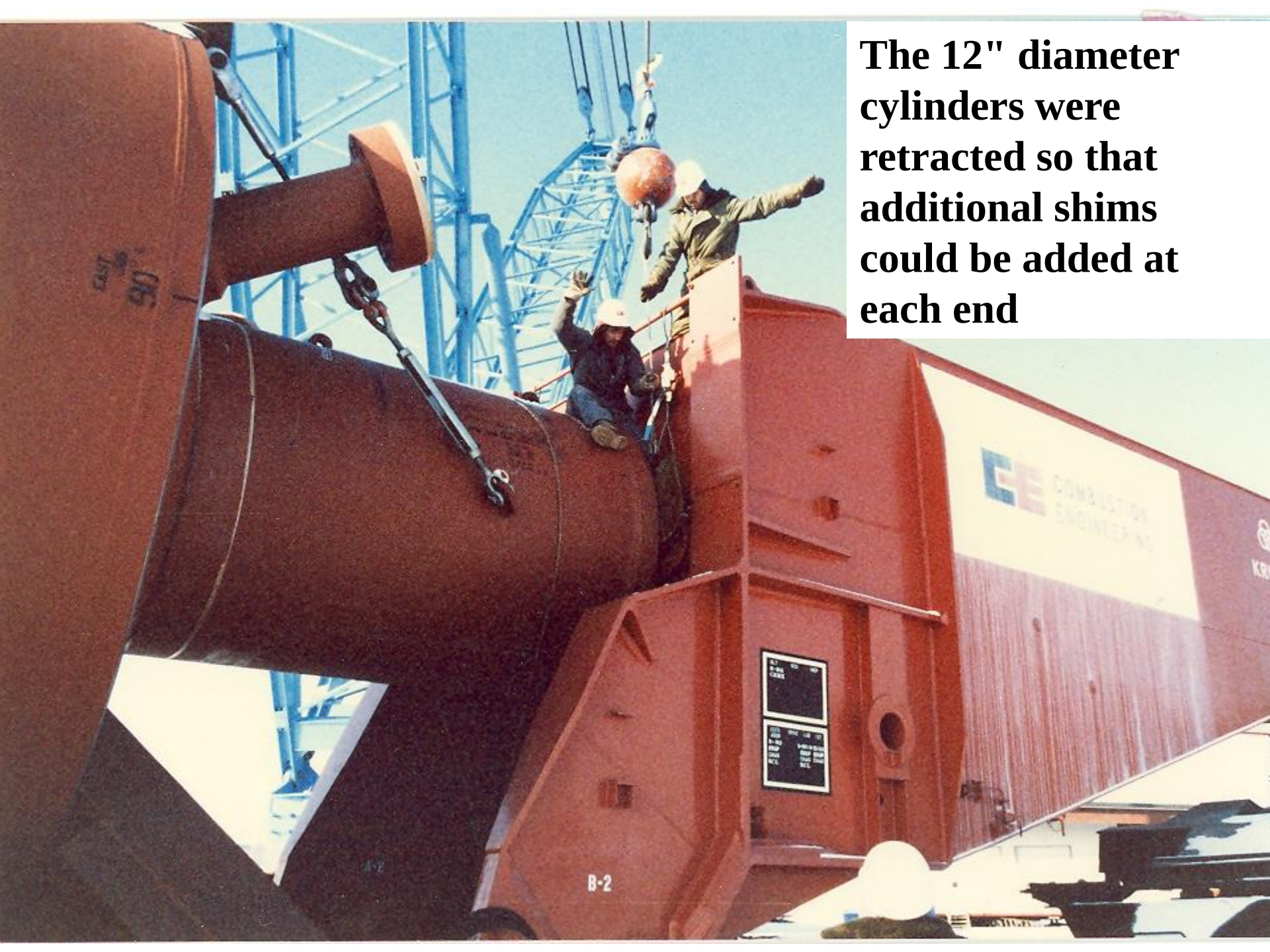

Two Hydraulic Cylinders
With Pins At Each End
Pin Connection
That Completes
The Force
Triangle
Swivel Structure
Centerline of one
half of the
schnabel car and
the swivel
structure
Note: It is 196'-7" from this
centerline to the centerline on
the other half of the schnabel
car


Compression Pipe (Typical both ends)
Hooking up the left half of the schnabel car to the tension members
CEBX 800

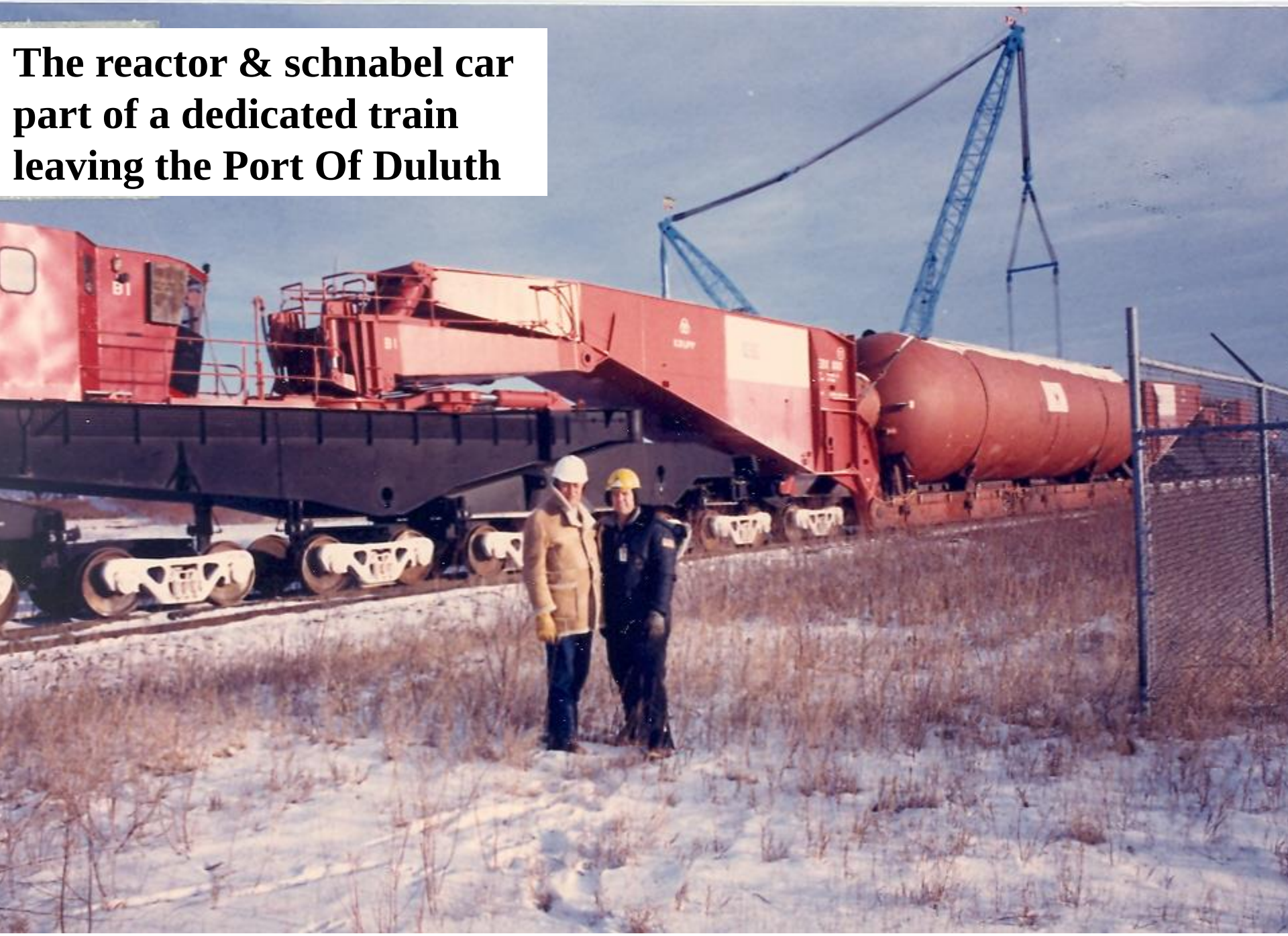

Hooking up the right side of the
schnabel car to the tension members

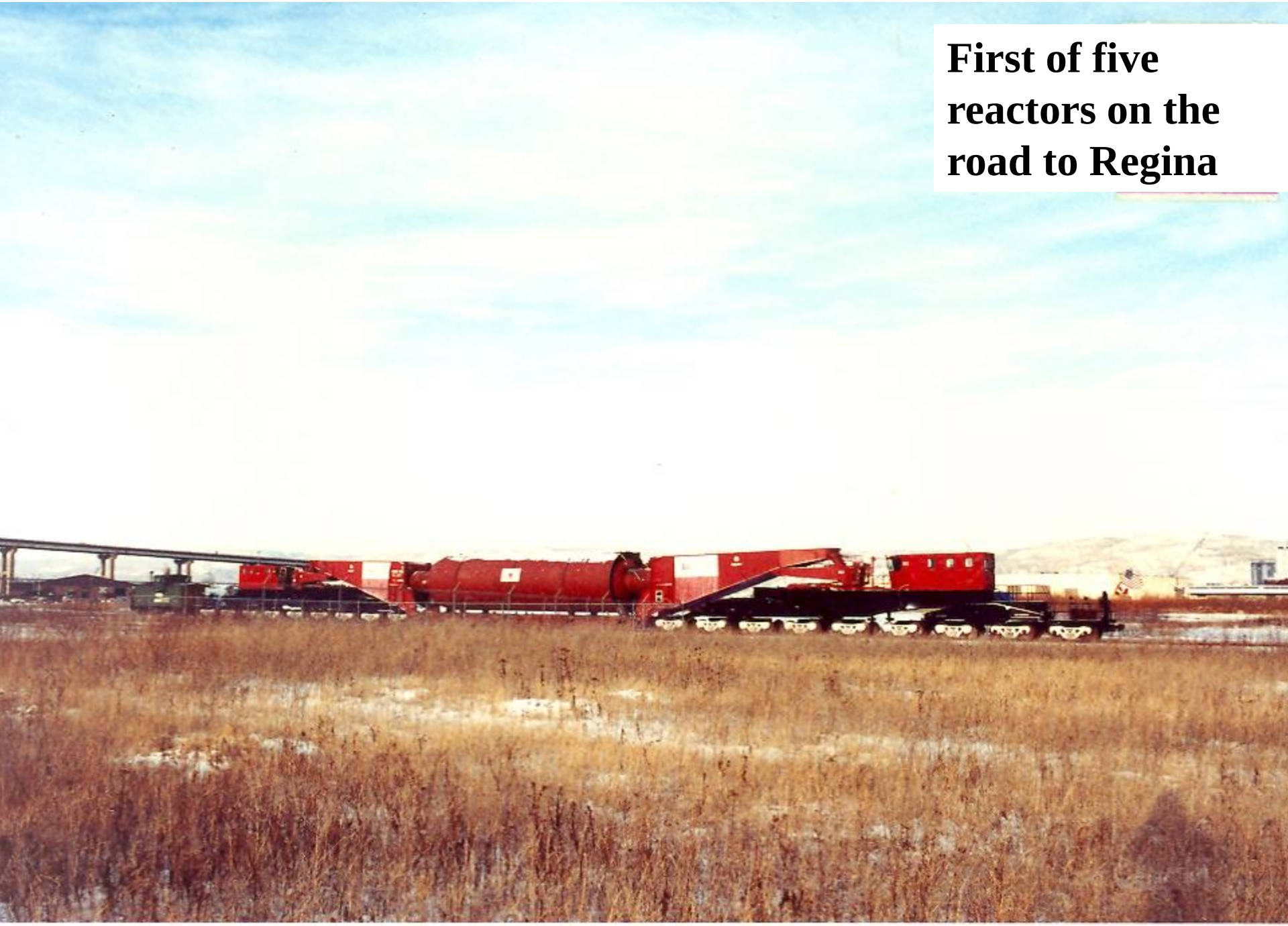
Adjusting the height of the tension members Above The Rails. The Goal is 24" ATR


Note that 12" crane mats were added under the tension members so that more shims could be added at each end



The 12" diameter cylinders were retracted so that additional shims could be added at each end


The reactor & schnabel car
part of a dedicated train
leaving the Port Of Duluth

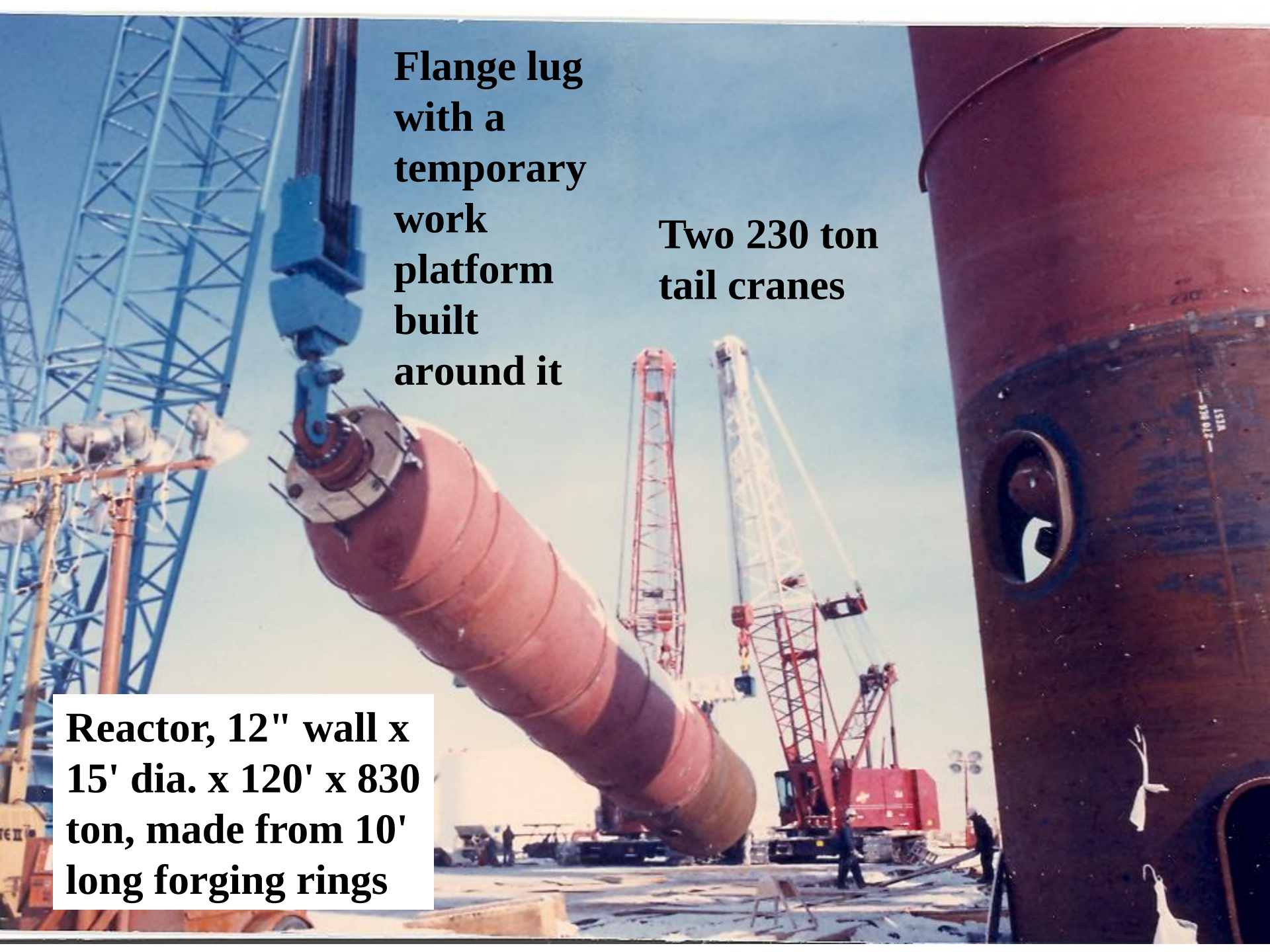


First of five reactors on the road to Regina

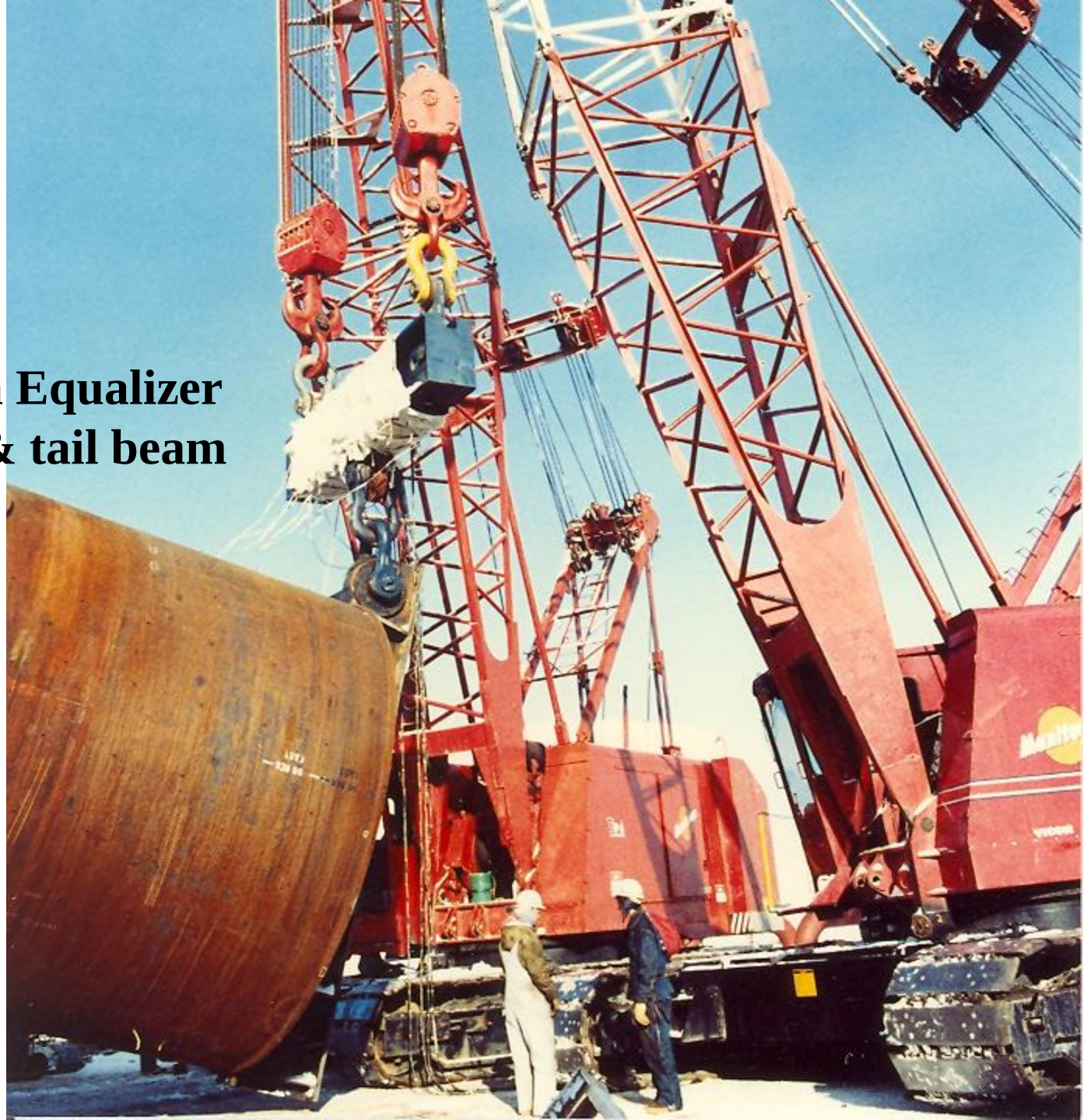
A reactor arriving in Regina with the tension members set at 12" ATR.

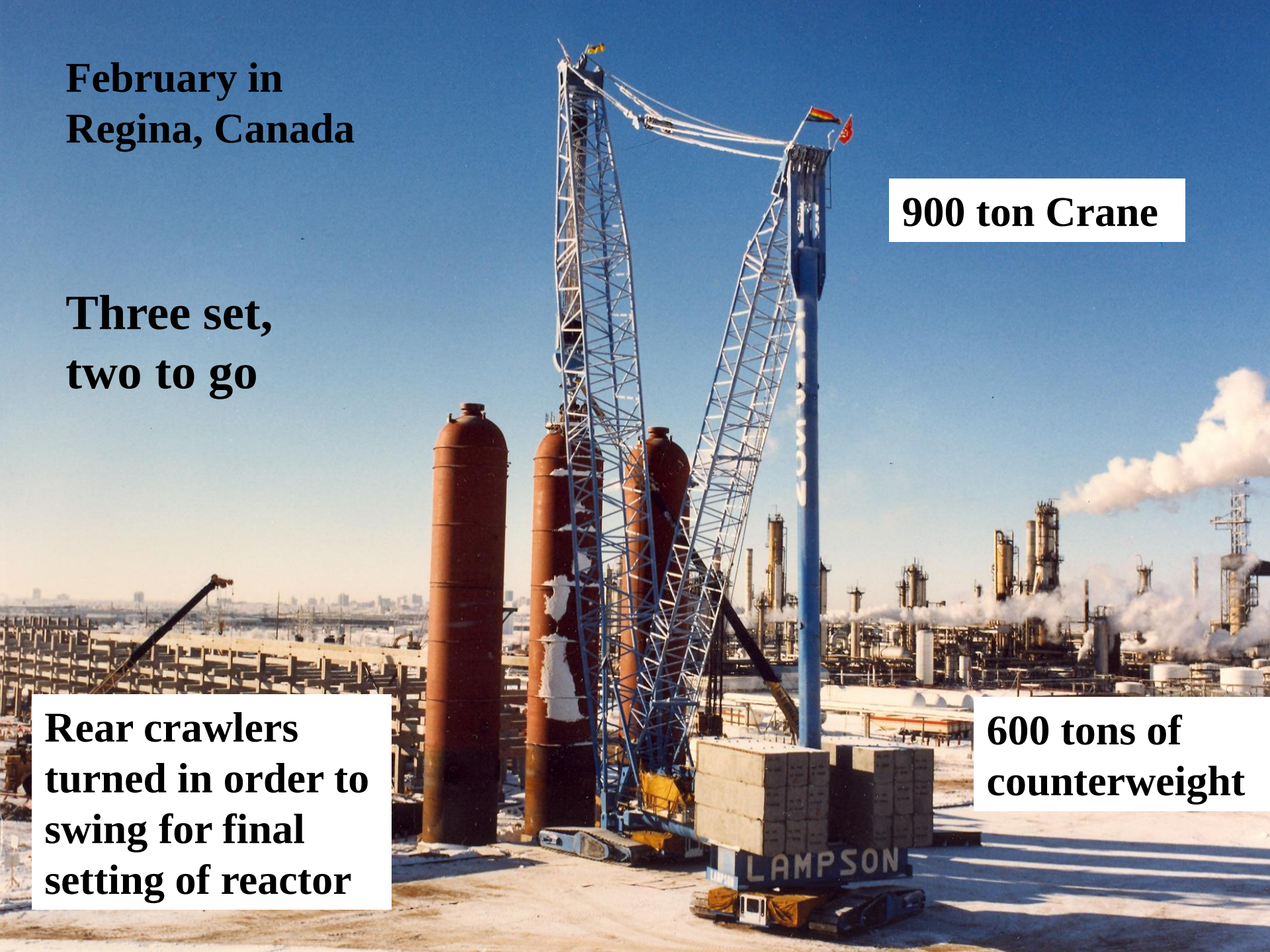
Note that the 12" cylinders are extended quite a bit further than when the lifting operation started


790 ton Reactor being offloaded using two 14" dia. std wall x 28' longitudinal pipe spreader bars
900 ton Crane
Note crane mats over the whole area


Flange lug with a temporary work platform built around it
Two 230 ton tail cranes
Reactor, 12" wall x 15' dia. x 120' x 830 ton, made from 10' long forging rings

600 ton Equalizer beam & tail beam




February in
Regina, Canada
900 ton Crane
Three set,
two to go
Rear crawlers
turned in order to
swing for final
setting of reactor
600 tons of
counterweight
LAMPSON

FINÉ