

**Manufacturing Insights:
Single Piece Flow**

SCENE 1.

WARNING

CG: FBI WARNING

WHITE TEXT CENTERED ON BLACK TO

BLUE GRADIENT

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SCENE 2.

tape 40, 01:00:00-01:00:12

SME logo, with music

SCENE 3.

MI logo opening

NARRATION (VO) :

MANUFACTURING INSIGHTS, MANUFACTURING ENGINEERING
MAGAZINE'S VIDEO SERIES FOR PROCESS IMPROVEMENT.

01.42.23 - 01.42.33

THIS VIDEO DEMONSTRATES HOW A MEDICAL

02.16.11 - 02.16.18

MANUFACTURING COMPANY TRANSFORMED FROM PRODUCING
LARGE BATCHES OF PRODUCTS TO MAKING ONLY WHAT THE
CUSTOMER NEEDS, WITH SINGLE PIECE FLOW.

SCENE 4.

ConMed supplied footage of
operation

NARRATION (VO) :

CONMED LINVATEC, OPERATES A MANUFACTURING FACILITY
IN LARGO, FLORIDA THAT MAKES SURGICAL INSTRUMENTS
FOR A WIDE VARIETY OF APPLICATIONS. MOST PRODUCTS
ARE SMALL AND EXTREMELY PRECISE SO QUALITY IS
STRINGENTLY CONTROLLED.

01.41.31 - 01.41.41

SCENE 5.

NARRATION (VO) :

AND BECAUSE THEY MUST FOLLOW ALL THE FDA

01.42.42 - 01.42.52

GUIDELINES FOR DOCUMENTATION AND PRODUCTION, THEY MUST BE CAREFUL THAT ALL THE CHANGES THEY MAKE TO THEIR MANUFACTURING PROCESSES DON'T VIOLATE ANY REGULATIONS.

01.41.45 - 01.41.55

SCENE 6.

NARRATION (VO) :

01.37.04 - 01.37.14

CONMED LINVATEC BEGAN APPLYING LEAN THINKING TO ITS OPERATIONS BACK IN THE MID '90S WHEN MARK SNYDER BECAME THE VICE PRESIDENT OF

01.37.33 - 01.37.43

MANUFACTURING. MARK TOOK ON THE TASK OF TEACHING LEAN TO EVERY SINGLE EMPLOYEE, REGARDLESS OF WHETHER THEY WORKED ON THE PRODUCTION FLOOR OR IN THE OFFICE.

SCENE 7.

NARRATION (VO) :

01.43.09 0 01.43.19

LIKE MANY COMPANIES, THEY USED MATERIAL RESOURCE PLANNING SOFTWARE TO HANDLE PRODUCTION SCHEDULING, MATERIAL ORDERING, AND SALES FORECASTING.

SCENE 8.

NARRATION (VO) :

02.10.30 - 02.10.50

AND LIKE MANY OTHER COMPANIES, CONMED LINVATEC PRODUCED THOUSANDS OF PRODUCTS IN LARGE BATCHES, AND THEN STORED THEM IN WAREHOUSES, SO THE CUSTOMER COULD JUST ORDER FROM STOCK.

SCENE 9.

NARRATION (VO) :

01.43.42 - 01.44.10

BUT SOMETIMES, PROBLEMS WOULD ARISE WHEN THEY WOULD RUN OUT OF A POPULAR ITEM. THIS SHORTAGE FORCED THEM TO RE-PRIORITIZE PRODUCTION IN THE MIDDLE OF LARGE BATCHES. IF CUSTOMERS HAD ONLY ORDERED WHAT WAS ON THE SHELF, EVERYTHING WOULD

HAVE BEEN GREAT.

SCENE 10.
01.12.56 to 01.13.36

Luke Sauer:

And just for some examples in the blade factory, our lead time used to be three weeks for a batch of 1,000 to 5,000 shaver blades. Now we process anywhere from 6 to 360, our largest batch size, in 2 to 4 hours. That responsiveness has given us the ability to truly make what the customer is buying. The additional benefit is that we're able to respond very quickly to fluctuations. Predicting what the customer is buying is very difficult.

SCENE 11.
01.52.15 - 01.52.26

NARRATION (VO) :

SINCE THEY KNEW ITS COMPETITION WAS ONLY A PHONE CALL AWAY, THEY BEGAN TO WORK TOWARDS THE GOAL OF MAKING EACH PRODUCT EVERYDAY, ONE AT A TIME.

SCENE 12.
02.22.00 - 02.22.06

NARRATION (VO) :

02.21.30 - 02.21.50 carry into
scene 13

ONE OF THE KEYS TO THE SUCCESS OF SINGLE PIECE FLOW AT CONMED LINVATEC IS THAT THEY OPERATE A SMALL FACILITY TO DEVELOP THEIR OWN PRODUCTION EQUIPMENT SPECIFICALLY FOR SINGLE PIECE FLOW.

SCENE 13.

NARRATION (VO) :

02.21.14 - 02.21.30

MUCH MORE THAN JUST A TOOL ROOM, THE STAFF ENGINEERS HAVE DEVELOPED HIGHLY AUTOMATED YET SIMPLE MACHINES THAT ENABLE LOW COST PRODUCTION WITHOUT MASS PRODUCTION VOLUMES.

SCENE 14.

NARRATION (VO) :

01.50.17 - 01.50.26

AND SINCE CONMED LINVATEC BUILDS THEIR OWN

MACHINES, IF THEY EVER HAVE PROBLEMS, THEIR IN-
HOUSE EXPERTS FIX THEM.

SCENE 15.
01.49.49 - 01.49.58

NARRATION (VO) :

AND IN SOME CASES, WHEN A MACHINE MAY BE PRONE TO
BREAKDOWN, A SPARE MACHINE IS KEPT ON HAND RIGHT
IN THE PRODUCTION AREA SO IT CAN BE ROLLED IN AND
USED UNTIL THE OTHER MACHINE CAN BE REPAIRED.

SCENE 16.

01.39.08 - 01.39.20

02.08.34 - 02.08.49

NARRATION (VO) :

MACHINING OF THE SURGICAL INSTRUMENTS REQUIRES THE
USE OF A VARIOUS CUTTING FLUIDS, SO BEFORE THE
INSTRUMENTS CAN BE PACKAGED FOR SHIPMENT, THEY
MUST BE CLEANED. IN THE PAST, LARGE TANKS WERE
USED FOR CLEANING HUNDREDS OF PRODUCTS, ALL AT
ONCE.

SCENE 17.

02.12.00 - 02.12.10

02.23.21 - 02.23.49

NARRATION (VO) :

BUT NOW SMALLER TANKS ARE USED TO ACCOMPLISH THE
CLEANING IN MUCH SMALLER BATCHES. BECAUSE THE
ULTIMATE GOAL IS ONE PIECE FLOW, A NEW MACHINE HAS
BEEN DEVELOPED THAT USES STEAM AND HOT AIR TO
CLEAN AND DRY A SINGLE PRODUCT IN SECONDS.

SCENE 18.

TAPE 1 02.01.26 - 02.01.36

NARRATION (VO) :

EVERY SINGLE PIECE OF EQUIPMENT IN THE FACILITY
THAT CAN BE MOBILE IS ON WHEELS.

SCENE 19.

02.14.53 - 02.15.10

NARRATION (VO) :

AND BECAUSE THEY ARE ALWAYS CHANGING LAYOUTS TO
ACCOMMODATE PRODUCTION DEMANDS, THIS ADDED
MOBILITY KEEPS THE COST OF MAKING THESE CHANGES

LOW BECAUSE NO SPECIAL DEVICES ARE REQUIRED TO
MOVE EQUIPMENT AROUND.

SCENE 20.
01.51.30 - 01.51.49

NARRATION (VO) :

THE REASON THESE MACHINES MUST BE CUSTOM BUILT IS
THAT THEY NEED THEM TO DO ONLY A SPECIFIC TASK AND
BE A SPECIFIC SIZE.

SCENE 21.
01.54.23 to 01.54.30

NARRATION (VO) :

FOR EXAMPLE, THIS MACHINE IS PROGRAMMED TO
AUTOMATICALLY DIP THE PART INTO CLEANING
SOLUTION...

SCENE 22.
01.53.57 to 01.54.07

NARRATION (VO) :

...THEN SHAKE OFF THE REMAINING FLUID. NO MACHINE
SUPPLIER IS GOING TO BE ABLE TO OFFER A STANDARD
VERSION OF THIS TYPE OF MACHINE.

SCENE 23.
Training photos from ConMed

NARRATION (VO) :

HAVING CUSTOM MACHINES IS GOOD, BUT CONMED
LINVATEC REALIZED THEY NEEDED TO MAKE EVERY PERSON
UNDERSTAND LEAN IN ORDER TO KEEP ITS IMPROVEMENT
EFFORTS GOING.

SCENE 24.
01.07.51 to 01.08.12

Luke Sauer:

The culmination of our kaizen events is not just
one person's output, it's the team output, using
those lean guidelines as well as some of those six
sigma tools, we found that as long as you
continually include the processes that are
affected, then their buy-in and support is much
greater.

SCENE 25.
training photos from ConMed

NARRATION (VO) :

EACH EMPLOYEE ATTENDS BETWEEN 20 TO 40 HOURS OF
LEAN TRAINING AS PART OF A KAIZEN EVENT.

SCENE 26.

NARRATION (VO) :

More training photos

EACH KAIZEN EVENT IS A FOCUSED EFFORT LASTING
ABOUT A WEEK WHERE EMPLOYEES FROM THROUGHOUT THE
COMPANY PARTICIPATE TO GENERATE AS MANY
IMPROVEMENTS AS POSSIBLE IN THE TIME ALLOWED.

SCENE 27.

01.29.29 to 01.30.08

Luke Sauer:

We found, particularly for professionals, whether
you're an engineer, planner, in purchasing, this
gives you the greatest exposure to our systems
here, as well as learning what our processes and
methodology is. Each event, we have two types of
events here, a full week Kaizen, where you go
through eight hours of training, and then we have
tiger teams, which are half-day events, and the
training is geared toward whatever the half-day
goals are for that event.

Cut away footage

02.24.28 - 02.24.38

SCENE 28.

01.30.18 to 01.30.51

Luke Sauer:

Our goal is to ensure that at least every event
has 50% production employees and 50%
professionals. That way you not only get a mix of
the experienced operators, but we also bring in
operators from other areas so that we can get an
outside of the area we're doing the event in
perspective. That enables us to ensure that we
get the cross training.

SCENE 29.

NARRATION (VO) :

02.24.05 - 02.24.16

THE EXCEPTIONAL EMPLOYEE CULTURE WITHIN THIS
COMPANY IS SOMETHING THAT DEVELOPS STARTING WITH
AN EMPLOYEES FIRST DAY ON THE JOB.

SCENE 30.

Luke Sauer:

01.04.40 to 01.05.17

Cut away: 2 people training

02.23.51 to 02.23.58

That training is even incorporated into some of our orientation processes, where we introduce new employees to 5S and the lean tools. So our goal is to let new employees as well as existing employees understand that the training leads us to that world class environment, and the results of the events get us the results that get us the new product development, the robust processes, and the profitability that we're looking for in meeting our customers' needs.

SCENE 31.

Sort
Set In Order
Shine
Standardize
Sustain.

5S Still Image behind text

NARRATION (VO) :

ONE OF THE MOST IMPRESSIVE THINGS YOU NOTICE AT CONMED LINVATEC IS HOW CLEAN AND ORGANIZED THE FACTORY IS. THIS IS DUE TO THE APPLICATION OF THE 5S LEAN TOOL THAT STANDS FOR **SORT, SET IN ORDER, SHINE, STANDARDIZE, AND SUSTAIN.**

SCENE 32.

Trophy photo

NARRATION (VO) :

TO KEEP PEOPLE THINKING ABOUT A WELL ORGANIZED WORK CELL, CONMED LINVATEC GIVES OUT A TROPHY EVERY WEEK.

SCENE 33.

01.24.21 to 01.24.43

Luke Sauer:

Every one of the factory managers, as well as our vice president of manufacturing, participates in a 50-minute audit once a week. We award a 5S trophy and each team or cell is recognized on whether or not they have 3 months, 6 months, or 12 months of consecutive A's, which means zero non-conformance.

SCENE 34.

02.24.46 - 02.25.05

NARRATION (VO) :

THE 5S TROPHY IS ONLY ONE WAY THE PRACTICE OF 5 S IS REINFORCED . SOMETIMES THE FACTORY MANAGER GOES OUT TO THE FACTORY DURING A BREAK AND COLLECTS ALL

THE TOOLS THAT WERE LEFT OUT.

SCENE 35.
01.24.52 to 01.25.46

Luke Sauer:

The factory manager, Andy Matyk, used that very effectively, so that when I came back from break, if I was working at that workstation, I didn't have my tools, and I had to go explain to the factory manager why I didn't return them. It's a very effective way. We don't threaten people, we don't fire them, write them up, we nag you to death. That's the most effective methodology until you understand this is the way it is. It's a huge benefit, because then I have what I need. The best compliment we get on our 5S here is from our new employees. They've never worked in a place where when you're in training, your tools are right there, they're instantly available, you know where to put them back, and it reduces our training time as well.

Cut away 02.28.50- 02.29.01

SCENE 36.
02.35.47 - 02.35.57

NARRATION (VO) :

TO KEEP TRACK OF BORROWED TOOLS, CONMED LINVATEC USES A TOOL TAG TO INDICATED THE TOOL IS BORROWED, NOT JUST MISSING.

SCENE 37.
01.23.08 to 01.23.54

Luke:

By constantly having that as part of our culture, we can maintain not only the location of all those tools, but there are five principles that we believe 5S is the basic cornerstone—enabling perfect quality, employee satisfaction, making sure we have a visual workplace, waste elimination, and most importantly we have a safe place to work in. Those concepts drive our 5S, and it is probably the single cornerstone of all our lean methodologies that we've credited not only to the continuous improvement process, but

On screen Text:
Perfect Quality
Employee Satisfaction
Visual Workplace
Waster Elimination
Safe Workplace

the discipline to get toward that world class manufacturing that we want to be.

SCENE 38.
01.39.23 - 01.39.30

NARRATION (VO) :

TO FURTHER REDUCE VARIATION IN PRODUCTION, EACH AREA USES STANDARD WORK SHEETS TO DESCRIBE THE WORK BEING PERFORMED IN EACH CELL.

SCENE 39.
01.46.52 - 01.47.04

Zoom out

NARRATION (VO) :

FOR EXAMPLE, THE ETCHING STATION STANDARD WORK SHEET SHOWS HOW THE WORK IS PERFORMED SITTING AT THIS BENCH.

SCENE 40.
01.57.51 - 01.58.02

NARRATION (VO) :

OTHER MORE COMPLICATED STANDARD WORK SHEETS DESCRIBE HOW A CELL OPERATES WITH DIFFERENT STAFFING LEVELS NEEDED FOR INCREASED OR DECREASED OUTPUT.

SCENE 41.
01.14.14 to 01.15.18

Luke Sauer:

The standard worksheets are there to document the sequence and line balancing. Our audit process not only audits whether or not we are following our work instructions, because we are part of the regulated industry, we're ISO certified and regulated through the FDA. We actually audit our standard worksheets as part of our auditing process, and the standard worksheets are updated every time we do an event, or as an engineer has a need to change those. The employees will be the first to say that this standard worksheet isn't right, or that we can't meet our goal and need to address those issues. So it's actually a good *** accountability for both the person that has to use it as well as the engineers that are responsible

for updating it.

Needs cut away here ***

01.56.57 - 01.57.21

SCENE 42.

02.16.20 - 02.16.35

NARRATION (VO) :

OF ALL THE SUBJECTS DISCUSSED SO FAR, THE MOST IMPORTANT PHYSICAL ADVANTAGE CONMED LINVATEC HAS IS ITS CELL-BASED PRODUCTION THAT ENABLES SINGLE PIECE FLOW.

SCENE 43.

01.55.22 - 01.55.41

NARRATION (VO) :

A GREAT EXAMPLE OF THIS IS THE BLADE PACKAGING CELL WHERE A SINGLE OPERATOR IS ABLE TO MAINTAIN A CYCLE TIME OF LESS THAN HALF A MINUTE. ENGINEERS AND OPERATORS DEVELOPED THIS CELL TO MEET THE CUSTOMER DEMAND RATE OF ONE PACKAGE EVERY 24 SECONDS.

SCENE 44.

01.11.33 to 01.12.15

Luke:

As part of becoming a world class organization, we really focus on lead time. Lead time has a direct correlation to inventory, meeting the customers' needs. One of our goals, from the very beginning, was to be able to produce today what sold yesterday. Even though in some of our factories we have a sterilization queue that we're building to, our goal is to be just in time. Most of our factories today build in that factory what actually sold yesterday.

SCENE 45.

02.02.11 - 02.02.22

NARRATION (VO) :

IN ORDER TO KEEP THE CELL OPERATOR FOCUSED ON VALUE ADDED WORK, CONMED LINVATEC USES THE CONCEPT OF A "WATER SPIDER."

SCENE 46.

Spider image .tiff

NARRATION (VO) :

USE OF THE TERM REFERS TO HOW A WATER SPIDER
GLIDES EASILY OVER THE SURFACE OF THE WATER BUT
NEVER ENTERS THE WATER.

SCENE 47.

02.05.15 - 02.05.26

NARRATION (VO) :

SO THE WATER SPIDERS ARE ANALOGOUS TO THE PEOPLE
WHO TAKE CARE OF EVERYTHING OUTSIDE THE CELL,
ENABLING THE PRODUCTION TO KEEP RUNNING.

SCENE 48.

02.07.08 - 02.07.18

01.58.37 - 01.58.47

NARRATION (VO) :

WHILE SOME COMPANIES CALL THIS ROLE THE MATERIAL
HANDLER, HERE THEY DO DOCUMENTATION, MATERIAL
DELIVERIES, CLEANING UP, AND EVEN HELP WITH
CHANGEOVERS.

SCENE 49.

01.32.50 to 01.33.59

Luke Sauer:

Our operators, when we first started doing events,
did anything but the value added activity. We
actually measured in our receiving and inspection
department, where the quality tech that was doing
inspection was spending 20% on inspection and 80%
on things other than inspection. The water spider
enabled the quality tech to do the inspection part
of the job and to utilize their skills. In
manufacturing we found less of that activity
occurring, but what we found was, particularly
during setups, the operator was leaving the cell
frequently to go get their parts, to finish the
setup. Our goals in our initial flow events was to
keep the operator in the cell and let the water
spider deliver everything to them and do the non-
repetitive activities, so the operator could do
the activities required to make the parts.

Need cut away of spider working

TAPE 1 02.00.53 - 02.01.06

SCENE 50.

NARRATION (VO) :

01.55.41 - 01.56.15 carry over
all of scene 51

THE CELLS IN THIS COMPANY ARE DESIGNED TO FOLLOW THE CONCEPT OF "CHAKU-CHAKU" OR LOAD-LOAD. THE "CHAKU-CHAKU" MOVEMENT CREATES SINGLE-PIECE FLOW, AS THE OPERATOR MOVES THEY TAKE THE PART FROM ONE MACHINE AND LOAD IT INTO THE NEXT.

SCENE 51.

NARRATION (VO) :

See above

THE FLOW PRODUCED IN THIS CELL IS FAST BECAUSE THE OPERATOR MOVES FROM MACHINE TO MACHINE AT A STEADY PACE AND THE MACHINE CYCLES ARE FAST ENOUGH TO HAVE THE PART READY BEFORE THE OPERATOR COMES AROUND FOR THE NEXT CYCLE.

SCENE 52.

TAPE 1 01.59.58 - 02.00.08

NARRATION (VO) :

TO BUILD THESE CELLS, THEY FOLLOW A PHILOSOPHY OF QUICK AND CRUDE, NOT EXPENSIVE AND ELEGANT.

SCENE 53.

01.26.55 to 1.27.50

Luke Sauer:

Every new technology has its own set of things you have to learn, whether it's the maintenance side of it, whether it's the capability, robustness. Once we found a process that works for us, we would rather duplicate that and create the backups so that when we have a piece of equipment go down, then you move the backup equipment in and do your troubleshooting offline, so it doesn't affect the flow of the cell. All this has been a huge effort by a wide variety of folks, particular in our equipment development area, the continuous improvement team, and just as importantly, the process owners understanding that it's not the most expensive machine that gets us where we want to go. It's actually been a huge learning process

Cut away 02.11.15 - 02.11.25

Cut away 02.11.39 - 02.11.49

for us working with our suppliers.

SCENE 54.
02.01.14 - 02.01.21

NARRATION (VO) :

TO AVOID CONTAMINATION BETWEEN WORK CELLS, THEY BUILT A WALL BETWEEN THE MACHINING CELLS AND PACKAGING CELLS FOR THE BLADE PRODUCT LINE.

SCENE 55.
01.38.32 - 01.38.38

NARRATION (VO) :

BECAUSE THEY DON'T WANT THESE WALLS TO STOP THE PRODUCT FLOW, THEY CUT SMALL HOLES AT SPECIFIC POINTS TO ALLOW SINGLE PIECE FLOW BETWEEN CELLS.

TAPE 1 02.00.31- 02.00.37

SCENE 56.
02.34.21 - 02.34.32

NARRATION (VO) :

IT'S OBVIOUS TO EVERYONE AT THIS COMPANY THAT THE LEAN CULTURE IS THE REASON THEY HAVE BEEN SO SUCCESSFUL IN SUCH A COMPETITIVE ENVIRONMENT. BUT EVEN WITH ALL THE IMPROVEMENTS, CONMED LINVATEC EMPLOYEES REALIZE THEY ARE ON A CONTINUOUS LEAN JOURNEY. WITH MANY MILES TO TRAVEL AND NO END IN SIGHT.

02.25.01 - 02.25.15

SCENE 57.
02.31.59 - 02.32.12

NARRATION (VO) :

GOING FORWARD, CONMED LINVATEC IS ALSO APPLYING LEAN TECHNIQUES TO NEW PRODUCT DESIGN AND PROTOTYPING. THEIR PLANS CALL FOR CONTINUED IMPROVEMENTS TO THEIR MANUFACTURING OPERATIONS AND TO THE MEDICAL FIELD WITH COMPETITIVELY PRICED NEW PRODUCTS.

02.29.56 - 02.30.10

Fade to Black with half blue background

SCENE 58.

Manufacturing Insights wishes to thank the following organization for their assistance in the production of this program

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