

Manufacturing Insights

Concept Modeling

<p>Scene: 1</p> <p>CG: FBI warning</p>	
<p>Scene: 2</p> <p>ANIMATION: SME Logo</p>	
<p>Scene: 3</p> <p>Standard MI Opening</p>	<p><u>Narrator (VO):</u></p> <p>MANUFACTURING INSIGHTS . . .</p> <p>MANUFACTURING ENGINEERING MAGAZINE'S VIDEO SERIES FOR PROCESS IMPROVEMENT.</p>
<p>Scene: 4 Text: Concept Modeling</p> <p>12.01.42</p> <p>03.15.32</p> <p>03:17:47 HEAD sliding back & forth</p> <p>08.02.41</p> <p>identifying shots of SPI Modeler Maker</p> <p>& Genisys</p>	<p><u>Narrator (VO):</u></p> <p>THIS PROGRAM WILL REVIEW CONCEPT MODELING MACHINES * AND THEIR IMPACT ON NEW PRODUCT DEVELOPMENT. * WE WILL LOOK AT THREE *DIFFERENT MACHINES, AND SEE HOW ENGINEERS ARE ADAPTING THEIR APPROACH TO PROJECTS TO REAP THE MOST BENEFIT.</p>
<p>Scene: 6 Text: RAYTHEON TI SYSTEMS</p> <p>03.11.55</p>	<p><u>Narrator (VO):</u></p> <p>WE WILL SEE CONCEPT MODELERS IN USE AT ...</p> <p>RAYTHEON TI SYSTEMS, * WHERE DESIGN ENGINEERS ARE USING CONCEPT MODELERS TO SAVE TIME IN NEW PRODUCT DESIGN ...</p>

03.22.04	
Scene: 7 Text: UNION SPECIAL 08.10.23 07.17.07 08.13.49	<u>Narrator (VO) :</u> ...AND AT, UNION SPECIAL, WHERE CONCEPT MODELING MACHINES *ARE USED FOR NEW PRODUCT DEVELOPMENT, AND AS A SERVICE BUREAU, * OFFERING RAPID PROTOTYPING TO OUTSIDE COMPANIES...
Scene: 8 Text: UT AUTOMOTIVE 12.11.51 12.12.37 FADE TO BLACK <hr/>	<u>Narrator (VO) :</u> THEN WE'LL SEE HOW ENGINEERS AT UT AUTOMOTIVE * HAVE BROUGHT CONCEPT MODELERS UPSTREAM IN THE DESIGN PROCESS . . .
Image in box TO START Font: Concept Modeling	
Scene: 9 12.06.55	<u>Narrator (VO) :</u> OVER THE LAST FEW YEARS, CONCEPT MODELING MACHINES HAVE EVOLVED INTO A RELIABLE TOOL FOR DESIGN ENGINEERS.
Scene: 10 Engineer working on a CAD system 11.04.54	<u>Narrator (VO) :</u> CONCEPT MODELERS TRANSLATE GEOMETRY GENERATED BY CAD SOLID MODELING SOFTWARE TO BUILD A PHYSICAL PROTOTYPE.

<p>SAMPLE PART</p> <p>12.04.01</p>	
<p>Scene: 11</p> <p>C.U. of inkjets</p> <p>11.15.00</p>	<p><u>Narrator (VO) :</u></p> <p>THE INFORMATION DIRECTS THE MACHINE TO DEPOSIT BUILDING MATERIAL LAYER BY LAYER.</p>
<p>Scene: 12</p> <p>SAMPLE PART</p> <p>10.24.32</p>	<p><u>Narrator (VO) :</u></p> <p>THE REAL ADVANTAGE TO CONCEPT MODELERS IS IMPROVED COMMUNICATION. THE OFFICE FRIENDLY MACHINES CAN QUICKLY PRODUCE INEXPENSIVE MODELS.</p>
<p>Scene: 13</p> <p>10.23.28 IN</p> <p>10.23.46 OUT</p>	<p><u>Narrator (VO) :</u></p> <p>AS A TOOL FOR DESIGN ENGINEERS, CONCEPT MODELERS PROVIDE A 3-D PROTOTYPE TO TOUCH AND STUDY. IT IS A CHANCE TO CATCH MANUFACTURING ERRORS AT THE DESIGN STAGE AND A GREAT VISUAL AID TO SELL AN IDEA.</p>
<p>Scene: 14</p> <p>03.17.47</p>	<p><u>Narrator (VO) :</u></p> <p>ONE KEY POINT OF CONCEPT MODELERS IS THAT THEY ARE QUICK. DEPENDING ON THE SIZE OF THE PART AND THE TYPE OF CONCEPT MODELER, A PROTOTYPE WILL BE CREATED IN A FEW HOURS OR A FEW DAYS.</p>
<p>Scene: 15</p> <p>07.17.39</p> <p>08.04.21</p>	<p><u>Narrator (VO) :</u></p> <p>ANOTHER PLUS FOR CONCEPT MODELERS IS THAT THEY ARE SIMPLE TO USE. MOST OFTEN AN OPERATOR CAN COMPLETE TRAINING IN A DAY. * THE LONGEST TRAINING PERIOD REQUIRED TO BECOME FAMILIAR WITH THE MACHINE IS JUST ONE WEEK.</p>
<p>Scene: 16</p> <p>Various shots of the concept modeler</p>	<p><u>Narrator (VO) :</u></p> <p>POSSIBLY, THE BIGGEST PLUS FOR CONCEPT MODELERS IS THE PRICE TAG. WITH PRICES IN THE 50 TO 60-THOUSAND-DOLLAR RANGE, CONCEPT MODELERS ARE</p>

<p>03.16.00 IN 03.16.12 OUT 03.09.03</p>	<p>AFFORDABLE TO A RELATIVELY BROAD MARKET * COMPARED TO MORE TRADITIONAL RAPID PROTOTYPING MACHINES.</p>
<p>Scene: 17 Interview on camera font: Sean O'Reilly Development Engineer Ford Motor Company</p>	<p>sot: (O'Reilly) tape 13, tc.: 13:15:18, time: 13 seconds <i>IT'S AWFULLY IMPORTANT TO RECOGNIZE THE VALUE OF BEING ABLE TO TAKE AN ELECTRONIC MODEL OF A REAL HONEST TO GOD PHYSICAL PART AND PRODUCE THAT PHYSICAL PART IN PHYSICAL REALITY.</i></p>
<p>Scene: 18 Concept modeler at work 03.16.34 in 03.16.44 out 03.17.38 in 03.18.10 out</p>	<p>sot: (O'REILLY) tape 13, t.c.: 13:03:55, time: 19 secs <i>THINK OF IT AS A KIND OF LIKE A SPELL CHECKER, YOU KNOW SPELL CHECKER THE ROLE THEY PLAY FOR WORD PROCESSORS. WELL YOU CAN THINK OF THIS THING AS IN A SENSE BEING A GEOMETRY CHECKER FOR ENGINEERING 3-DIMENSIONAL PIECES. SO HERE'S A BASIC VALUE THAT THE TECHNOLOGY'S GOT PERIOD.</i></p>
<p>Scene: 19 Interview on camera</p>	<p>sot: (O'REILLY) tape 13, t.c.: 13:09:39, time: 38 secs <i>SO ONE OF THE ISSUES THERE I THINK IS THAT THE PLACES WHERE IT HAS BEEN USED TODAY IT HAS CLEARLY DELIVERED WITHIN THAT LITTLE ACTIVITY TREMENDOUS BENEFIT, SHORTENED LEAD TIMES, BETTER DESIGNS, I MEAN ALL OF THE THINGS THAT WE'RE LOOKING FOR HAVE COME OUT OF IT AND I DON'T THINK ANYBODY ARGUES THAT,</i></p>
	<p><i>BUT WHEN YOU STAND BACK AND YOU LOOK AT THOSE LITTLE AREAS IN THE CONTEXT OF THE BIG SYSTEM</i></p>

	<p>THAT THEY'RE IN THAT DOESN'T CONTRIBUTE TO THE BOTTOM LINE OF THE SYSTEM AND I THINK THAT'S ONE OF THE BIG PROBLEMS IS THAT IT REALLY NEEDS TO FIND ITS WAY INTO EVERY ACTIVITY INVOLVED IN DOING A FAIRLY COMPLEX SYSTEM.</p>
<p>Scene: 20</p> <p>Engineer working in lab with concept modeler</p> <p>08.00.30 in</p> <p>08.00.33 out</p> <p>08.02.05 in</p> <p>08.02.20 out</p>	<p>sot: (O'REILLY) tape 13, t.c.: 13:05:32, time: 24 secs</p> <p>SO I THINK IT'S A BIG STEP FORWARD, IT GET US IN GENERAL BEGINNING TO THINK IN 3-DIMENSIONS INSTEAD OF 2-DIMENSIONS AND GETS THAT THINKING HAPPENING IN THE ENGINEERING OFFICE AS WELL AS IN THE LAB OR WHEREVER THE OTHER MACHINES ARE AND IT JUST BEGINS TO SPREAD THAT WAY OF THINKING AND THAT WAY OF COMMUNICATING OUT INTO THE ENTIRE COMMUNITY. SO I THINK IT'S UNBELIEVABLY VALUABLE.</p>
<p>FADE TO BLACK _____</p>	
<p>Scene: 21</p> <p>tape 3</p> <p>t.c.: 3:20:33 raytheon display</p> <p>03.15.50</p>	<p><u>Narrator (VO):</u></p> <p>RAYTHEON T.I. SYSTEMS IN LEWISVILLE, TEXAS * WAS AN ORIGINAL BETA TESTING SITE FOR THE ACTUA 2100 BY 3-D SYSTEMS.</p>
<p>Scene: 22</p> <p>tape 3</p>	<p><u>Narrator (VO):</u></p> <p>DESIGNERS WORKING IN AN ENGINEERING ENVIRONMENT USED THE ACTUA 2100 TO MAKE ELECTRONIC DEVICES</p>

<p>03.01.27 in 03.01.37 out</p>	<p>FOR MILITARY MISSILES.</p>
<p>Scene: 23 tape 3 t.c.: 3:17:47 head sliding back & forth</p>	<p><u>Narrator (VO):</u> THE ACTUA 2100 EMPLOYS A MULTI -JET MODELING TECHNIQUE. IT'S SIMILAR TO INKJET PRINTING, APPLIED IN THREE-DIMENSIONS, WITH NINETY-SIX JETS ON THE HEAD, ORIENTED IN A LINEAR ARRAY.</p>
<p>Scene: 24 tape 3 t.c.: 3:20.09 side view of head sliding</p>	<p><u>Narrator (VO):</u> THE MODEL BUILDS IN SUCCESSIVE LAYERS WITH EACH JET APPLYING A SPECIALLY DEVELOPED THERMOPOLYMER MATERIAL WHERE NEEDED.</p>
<p>Scene: 25 t.c.: 3:17:36 display window & buttons "building"</p>	<p>THE MULTIPLE JET HEAD SHUTTLES BACK AND FORTH LIKE A LINE PRINTER ON AN "X" AXIS, BUILDING LAYER UPON LAYER TO FORM THE PHYSICAL PART.</p>
<p>Scene: 26 tape 3 t.c.: 3:18:42 cu. of sliding motion</p>	<p><u>Narrator (VO):</u> AS THE LAYERS BUILD, THE MODEL IS DISTANCED FROM THE HEAD ON THE "Z" AXIS. IF THE PART IS WIDER THAN THE PRINT HEAD, THEN IT'S RE-POSITIONED BY A CROSS-AXIS ON THE "Y" AXIS.</p>
<p>Scene: 27</p>	<p><u>Narrator (VO):</u> THE BUILDING PROCESS CONTINUES, WITHOUT INTERRUPTION, UNTIL THE MODEL IS COMPLETED.</p>

<p>tape 3</p> <p>t.c.: 3: 22:40 engineer takes product out of modeler.</p>	
<p>03.22.58</p>	<p>RECEPTION OF THE ACTUA 2100 AT RAYTHEON TI HAS BEEN POSITIVE.</p>
<p>Scene: 28</p> <p>Interview on camera</p> <p>font:</p> <p>Kevin Mahl</p> <p>Mechanical Design Engineer</p> <p>Raytheon TI Systems</p>	<p>sot: (Mahl) tape 1, t.c.: 1:01:24, time: 18 seconds</p> <p><i>WE DESIGN (cut out long pause) CAST PARTS, BASICALLY THE WHOLE VARIETY, ANYTHING FROM POTTING MOLDS, WHICH AREN'T ACTUALLY CAST, BUT THEN WE'LL DESIGN MECHANICAL PARTS, FIXTURES, AND HARDWARE . . .</i></p>
<p>Scene: 29</p> <p>tape 3</p> <p>t.c.: 3:22:59 engineer saws off model</p> <p>t.c.: 3:23:57 cleans w/file</p> <p>t.c.: 3:24: 38 c.u. engineer looks at part</p> <p>t.c.: 3:24:50 w.s. engineer looks at part & walks out of shot</p>	<p>sot: (Mahl) tape 1, t.c.: 1:03:32, time: 21 seconds</p> <p><i>CONCEPT MODELERS OFFER, I THINK, EVEN FASTER SPEED, AS WELL AS BETTER ACCESS TO THE ENGINEERS FOR THE CONCEPT PARTS FOR USE AS MODELS AND FOR DISPLAY-TYPE ITEMS WHERE YOU'RE IN A MEETING OR WHATEVER AND YOU WANT PEOPLE TO BE ABLE TO SEE WHAT YOU'RE ACTUALLY THINKING OF AND MAKE SUGGESTIONS ABOUT THE PART. THAT ACTUALLY RUNS A LOT FASTER FROM THE STANDPOINT OF THE ENGINEER.</i></p>
<p>Scene: 30</p> <p>Interview on camera</p> <p>font:</p> <p>Jan Haberer</p>	<p>sot: (Haberer) tape 2, t.c.: 2:21:27, time: 33 sec</p> <p><i>JUST LAST WEEK, WE HAD A DESIGN REVIEW FOR OUR SYSTEM AND IN ORDER TO GIVE A GOOD, HANDS-ON IDEA AS TO WHAT THE NEW CONFIGURATION OF MY SYSTEM WAS GOING TO LOOK LIKE, WE DID QUARTER-SCALE MODELS, AND WE BROKE OUR SYSTEM UP INTO FOUR PIECE PARTS, AND WE WERE ABLE TO DO A SECTION VIEW OF OUR SYSTEM, AND IT WAS</i></p>

<p>Mechanical Engineering Supervisor CCA Group - Raytheon TI Systems</p>	<p><i>INCREDIBLE</i></p>
<p>Scene: 31 tape 3 t.c.: 3:07:28 model box opened</p>	<p>sot: (Haberer) tape 2, t.c.: 2:22:40, time: 25 sec</p> <p><i>WE HAD CUSTOMERS IN AT THE MEETING WHO WERE ABLE TO GET A REAL GOOD LOOK AS TO SOME OF OUR PROBLEM AREAS, SOME OF THE AREAS OF CONCERN THAT YOU JUST CAN'T SHOW IN A FOIL OR AN OVERHEAD. IT DEFINITELY PROVIDED A VERY GOOD MEANS OF COMMUNICATING SOME OF OUR SUCCESSES, AS WELL AS SOME OF OUR PROBLEM AREAS. (tight)</i></p>
<p>Scene: 32 Interview on camera font: Robert Boyd Mechanical Design Engineer Raytheon TI Systems</p>	<p>sot: (Boyd) tape 2, t.c.: 2:07:03, time: 22 secs</p> <p><i>ONE OF THE BIG ADVANTAGES. WHEN YOU GO INTO MEETINGS WITH YOUR BOSS AND YOU'RE TELL HIM, EXPLAIN AND SHOW PICTURES OF THINGS, NOTHING TENDS TO HELP</i></p>
<p>Scene: 33 tape 3 t.c.: 3:02:55 three-legged model turned over</p>	<p><i>MORE THAN JUST ACTUALLY BRINGING A SOLID PART IN THERE AND SHOWING IT TO HIM AND REALLY HAVE THEM BE ABLE TO PICK IT UP AND SEE AND FEEL AND DO EVERYTHING TO KNOW WHAT YOU'RE REALLY TALKING ABOUT. Tc out 02.07.23</i></p>
<p>Scene: 34 tape 3 t.c.: 3:15:51 z/o from 3 to actua full shot</p>	<p>sot: (Mahl) tape 1, t.c.: 1:18:11, time: 13 seconds</p> <p><i>HAVING THE MACHINE ACTUALLY DIRECTLY CONNECTED AND WITHIN A FEW FEET OF OUR ENGINEERING AREA HAS VERY MUCH INCREASED OUR ABILITY TO ACCESS THE MACHINE AND TO USE THE MACHINE ON AN INSTANTANEOUS TYPE BASIS.</i></p>

<p>Scene: 35</p> <p>Interview on camera</p> <p>font:</p> <p>Brian Alexander</p> <p>Mechanical Design Engineer</p> <p>Raytheon TI Systems</p>	<p>sot: (Alexander) tape 2, t.c.: 2:00:43, time: 29 seconds</p> <p><i>WE'VE SHORTENED OUR DESIGN CYCLE QUITE A BIT WITH THE USE OF THIS WAX MODELER. WE'VE</i></p> <p><i>TAKEN INITIAL CONCEPTS FROM PRO ENGINEER TRANSFERRED THEM DIRECTLY TO THE MACHINE, WHICH OUTPUTS MODELS FOR US.</i></p>
<p>Scene: 36</p> <p>03:3:04:29 connector w/wires</p>	<p><i>WE'VE DONE CHECK FITS. WE'VE USED THEM IN OUR DESIGN REVIEW AND I WOULD SAY IT'S TAKEN WEEKS OFF OF OUR DESIGN CYCLE IN THAT WE CAN MORE QUICKLY KNOW THAT OUR DESIGN IS SOUND AND THAT ALL OF THE INTERACTIONS BETWEEN THE OTHER PARTS ARE SOUND.</i></p>
<p>Scene: 37</p> <p>Interview on camera</p>	<p>sot: (Mahl) tape 1, t.c.: 1:09:11, time: 34</p> <p><i>PRETTY MUCH IN ALL THE CASES IN OUR AREA WE'RE USING PRO E FOR GENERATING THE MODEL THAT WE</i></p> <p><i>THEN IN TURN SEND TO THE PART. WE JUST GENERATE A STANDARD STL FILE OUT OF PRO E AND THEN GO INTO THE ALLEGRO, THE GUI INTERFACE, FOR THE MODELER AND IT'S VERY SIMPLE TO USE.</i></p>
<p>Scene: 38</p> <p>tape 3</p> <p>t.c.: 3: 12:50 w.s. CAD info. typed</p> <p>t.c.: 3: 14:40 c.u. face</p> <p>t.c.: 3:14:00 keyboard</p> <p>t.c.: 3:12:32 c.u. of blue CAD model</p>	<p><i>THE ENGINEERS REALLY LIKE IT, IT TAKES ABOUT 4-5 STEPS, AND THE INTERFACE REALLY TELLS YOU ALL OF WHAT IT'S DOING, AND ASKS YOU TO SELECT THE ITEM YOU WANT TO BUILD, SELECT THE PARAMETERS, AND THEN IT ASKS YOU TO CONFIRM THAT THAT'S ACTUALLY WHAT YOU WANTED, AND OFF IT GOES.</i></p>

<p>Scene: 39</p> <p>tape 3,</p> <p>t.c.: 3: 14:43 rxn shot of engineer</p> <p>t.c.: 3: 15:18 actua</p> <p>t.c.: 3:21:44 finished product</p> <p>t.c.: 3:23:40 clean off w/ file</p>	<p>sot: (Mahl) tape 1, t.c.: 1:09:51, time: 24 seconds</p> <p><i>THERE'S VERY LITTLE TRAINING ACTUALLY REQUIRED. THE SOFTWARE ITSELF IS VERY SIMPLE TO USE, AND THEN THERE'S A LITTLE BIT OF TRAINING ON PROPER OPERATION OF THE MACHINE AND GETTING THE PLATEN AND EVERYTHING IN PLACE TO GET THE MODEL WHERE IT'S READY TO RUN AND THEN REMOVAL OF THE PART AND DOING THE CLEANUP TAKES A LITTLE BIT. MOSTLY IT'S JUST SHOWING PEOPLE WHERE THE EQUIPMENT IS TO DO IT.</i></p>
<p>Scene: 40</p> <p>tape 3</p> <p>t.c.: 3:19:36 c.u. actua head moves into light</p>	<p><u>Narrator (VO) :</u></p> <p><i>ALTHOUGH THE ACTUA 2100 HAS BENEFITTED THE DESIGN CYCLE AT RAYTHEON TI, ENGINEERS HAVE ENCOUNTERED A FEW BUMPS IN THE ROAD.</i></p>
<p>Scene: 41</p> <p>Interview on camera</p>	<p>sot: (boyd) tape 2, t.c.: 2:07:46, time: 28 secs</p> <p><i>BUT IF THEY COULD MAKE IT JUST A LITTLE BIT SOFTER, I THINK IT MIGHT BE A LITTLE BIT MORE RESILIENT AND NOT QUITE AS BRITTLE, BECAUSE SOMETIMES IT WILL CRUMBLE IN YOUR HANDS IF YOU DON'T HANDLE IT RIGHT,</i></p>
<p>Scene: 42</p> <p>tape 3</p> <p>t.c.: 3:24:18 c.u. clean part with file</p>	<p><i>OR SOMETIMES DURING CLEAN UP, YOU CAN DAMAGE A PART VERY EASILY FROM TRYING TO MOVE IT FROM THE PLATFORM, SO YOU HAVE TO BE VERY CAREFUL WITH IT, WHICH IS SOMETHING I'VE GOTTEN A LITTLE BIT MORE USED TO.</i></p>
<p>Scene: 43</p> <p>interview on camera</p>	<p><i>IN THE EARLY ONES, I CRATERED A COUPLE OF PARTS, BECAUSE I WAS A LITTLE TOO RAMBUNCTIOUS, I GUESS.</i></p>
	<p><u>Narrator (VO) :</u></p>

<p>Scene: 44</p> <p>tape 3</p> <p>t.c.: 3: 11:55 w.s. of CAD model</p>	<p>THE IDEA OF USING THE ACTUA 2100 DURING A PROJECT IS NEW AND SO REQUIRES A CHANGE OF MINDSET.</p>
<p>Scene: 45</p> <p>Actua 2100 working</p> <p>Engineer picking up the part & cleaning it</p>	<p><i>sot: (Mahl) tape 1, t.c.: 1:15:09, time: 20 seconds</i></p> <p><i>ONCE THEY'VE USED THE MODELER FOR THE PARTS THEY'VE ACTUALLY DESIGNED, I THINK THEY REALLY LIKE WHAT THEY SEE, AS WELL AS THE SPEED WITH WHICH THEY GET PARTS THAT THEY CAN ACTUALLY HANDLE. AND I THINK JUST GETTING THEM TO USE IT ONCE OR TWICE AND GETTING PAST THE TRAINING STAGE SO THEY UNDERSTAND THE MACHINE IS PROBABLY THE BIGGEST THING TO GETTING THE ENGINEERS TO USE THE PARTS.</i></p>
<p><u>FADE TO BLACK</u></p>	
<p>Scene: 46</p> <p>Identifying shot of Union Special Sanders creating a part</p> <p>08.03.14</p> <p>07.23.02</p> <p>07.13.24</p> <p>08.13.10</p>	<p><u>Narrator (VO) :</u></p> <p>AT UNION SPECIAL CORPORATION IN HUNTLEY, ILLINOIS, THE ORIGINAL PLAN WAS TO USE THE SANDERS PROTOTYPE MODEL MAKER FOR * IN-HOUSE INVESTMENT CASTING AND PRODUCT DEVELOPMENT. VERY SOON, HOWEVER, OUTSIDE * CLIENTS BECAME INTERESTED IN WORKING DIRECTLY WITH THE MODEL MAKER PRO AND * UNION SPECIAL TOOK ON THE ADDITIONAL ROLE OF SERVICE BUREAU.</p>
<p>Scene: 47</p> <p>C.U. of Model Maker</p> <p>08.04.55</p>	<p><u>Narrator (VO) :</u></p> <p>THE SANDERS MODEL MAKER USES TWO MOVEABLE INKJET PRINT HEADS TO COMPLETE THE BUILDING PROCESS.</p>
	<p><u>Narrator (VO) :</u></p>

<p>Scene: 48</p> <p>Various cutaways of the Model Maker</p> <p>08.04.20</p>	<p>DURING THE BUILD CYCLE, ONE HEAD DEPOSITS THERMOPLASTIC BUILD MATERIAL, WHILE THE OTHER HEAD DELIVERS SUPPORTING WAX MATERIAL. BOTH MATERIALS LEAVE THE INKJETS AS HOT LIQUID AND SOLIDIFY UPON IMPACT WITH THE COOLER BUILD SURFACE.</p>
<p>Scene: 49</p> <p>Various cutaways of the concept modeler.</p> <p>Need to Find scene</p> <p>Text: .63mm</p>	<p><u>Narrator (VO) :</u></p> <p>THE INKJET HEADS DIGITALLY DEPOSIT THE BUILD AND SUPPORT MATERIAL AS A SPHERE WHICH SPREADS OUT ON IMPACT TO A THICKNESS OF 2.5 THOUSANDS OF AN INCH.</p>
<p>Scene: 50</p> <p>Various cutaways of the concept modeler.</p> <p>08.00.44</p>	<p><u>Narrator (VO) :</u></p> <p>THIS SELECTIVE DEPOSITION PROCESS PERMITS TRACES TO BE PLACED NEXT TO EACH OTHER TO PRODUCE A UNIFORM LAYER OF MATERIAL.</p>
<p>Scene: 51</p> <p>Various cutaways of the concept modeler.</p> <p>08.05.47</p>	<p><u>Narrator (VO) :</u></p> <p>MATERIAL DEPOSITS ALONG A LINE AT RATES UP TO TWELVE INCHES PER SECOND. EACH NEW LAYER IS ESTABLISHED BY A HORIZONTAL MILLING TOOL THAT MACHINES A SMOOTH AND LEVEL SURFACE ON THE MODEL SUBSTRATE MATERIAL.</p>
<p>Scene: 52a</p> <p>Various cutaways of the concept modeler</p> <p>08.05.31</p> <p>TEXT: .12mm</p>	<p><u>Narrator (VO) :</u></p> <p>THE MILLING OPERATION ALLOWS THE MODELMAKER TO BUILD LAYERS AS THIN AS HALF A THOUSANDS OF AN INCH. THIS SIZE BUILD LAYER REDUCES STAIR STEPPING ON THE SURFACE OF THE MODEL TO EXTREMELY SMALL AMOUNTS.</p>
<p>Scene 52b</p>	<p><u>Narrator (VO) :</u></p>

<p>Photo needed 08.14.04 <u>FREEZE IMAGE</u></p>	<p>ONCE THE MODEL IS COMPLETE, THE SUPPORT STRUCTURE DISSOLVES OFF IN A CONTROLLED TEMPERATURE BATH.</p>
<p>Scene: 53 Completed part 08.02.41</p>	<p><u>Narrator (VO):</u> THE NEW SANDERS 3-D MODEL MAKER HAS BEEN REDESIGNED AND ONE RESULT IS THE MACHINE NOISE LEVEL IS NOW COMPARABLE TO OTHER CONCEPT MODELING MACHINES.</p>
<p>Scene: 54 Finished parts 08.10.26 08.10.40 08.15.10</p>	<p><u>Narrator (VO):</u> BECAUSE OF ITS EXTREMELY ACCURATE, BUT SLOW BUILDING PROCESS, THE SANDERS MACHINE IS NOT ALWAYS CONSIDERED A CONCEPT MODELER. * BUT FOR UNION SPECIAL, THE ABILITY OF THE UNIT TO MAKE EXTREMELY ACCURATE WAX PATTERNS FOR * INVESTMENT CASTING HAS ENABLED THEM TO MAKE CLOSE TOLERANCE METAL PARTS IN TWO OR THREE DAYS.</p>
<p>Scene: 55 Interview on camera Font: Walt Taylor Design Engineer Union Special 08.15.10 CUT AWAY OF TOOLING</p>	<p>sot: (Taylor) tape 7, t.c.: 7:01:21:26, time: 28 secs <i>WE NEEDED A QUICK WAY TO GET TO OUR CASTINGS ANYWAY WE COULD. SEE HOW THE CASTING WAS GOING TO WORK BEFORE ANY PRODUCTION TOOLING WAS ACTUALLY MADE UP. WE NEED DIRECT CASTINGS AND IF WE GOT LUCKY SOME TOOLING AS WELL</i></p>
<p>Scene: 56 Pouring liquid into mold (07:18:39)</p>	<p><i>WE WERE ABLE TO ACHIEVE THAT AND IT'S A PRETTY STEADY THING RIGHT NOW AS WELL. IT WAS A REAL ADDED BONUS AS WELL AS A LOT OF OTHER THINGS, BUT THE MAIN THING WAS GETTING TO INVESTMENT CASTINGS REAL QUICK</i></p>
<p>Scene: 57 Interview on camera</p>	<p>sot: (sunny) tape 6, t.c.: 6:27:15, time: 38 secs <i>AND WHEN YOU GET THE REQUEST FROM OUR CUSTOMERS</i></p>

<p>font: Yoichiro "Sunny" Ishikawa Sr. VP, R&D & General Manager Union Special CUTOUT 06:27:22:20 OUT CUT-IN 06:27:26:03 IN</p>	<p>THEY KIND OF EXPECT IT QUICKLY. IF YOU HAVE TO SAY, *****CUTOUT***** I CAN'T GIVE YOU ANYTHING FOR 8 WEEKS," MAYBE WINDOW OF OPPORTUNITY MAY BE GONE.</p>
<p>Scene: 58 Engineer working at CAD screen 07.18.00 07.17.43</p>	<p>WHEREAS IN THIS PROCESS WE CAN TRULY SAY "YEAH, WELL LET ME BRING A PART TO YOU NEXT WEEK AND SEE WHAT WE CAN DO," TREMENDOUS ADVANTAGE. AND LIKE I SAID, YOU KNOW, OTHER PEOPLE ARE INTERESTED IN THIS KIND OF A PROCESS TOO AND WE CAN OFFER THE SERVICES MAYBE WE CAN MAKE ADDITIONAL BUSINESS FOR UNION SPECIAL..</p>
<p>Scene: 59 CAD image 07.13.49</p>	<p><u>Narrator (VO):</u> PASLODE, A MANUFACTURER OF POWER FASTENING SYSTEMS, IS ONE OF UNION SPECIAL'S SERVICE BUREAU CUSTOMERS.</p>
<p>Scene: 60 Interview on camera font: Pat Driscoll Senior Project Engineer ITW Paslode</p>	<p>sot: (Driscoll) tape 6, t.c.: 6:02:46:13, time: 1:08 WELL, WE NEEDED A MEANS OF PROTOTYPING THE INVESTMENT CASTING TOOLING BECAUSE ONCE YOU MAKE A CHANGE, A SEVERE CHANGE TO THE INVESTMENT CASTING MOLD, THE WAX MOLD, YOU'RE OFTEN LOOKING AT A NEW MOLD AND FOR SOMETHING LIKE THIS PART, THIS COMES OFF AT AN ANGLE AND THERE IS SIDE ACTION, AND THERE'S SIDE HERE, THERE'S TOP ACTION HERE, THIS IS A VERY COMPLICATED MOLD.</p>
<p>Scene: 61 A</p>	<p>YOU KNOW WE MIGHT BE LOOKING AT FIFTY GRAND WITH THE COINING TECHNOLOGY AND THE MACHINING</p>

<p>08.01.15 OUT</p>	
<p>Scene: 65 Interview on camera</p>	<p>SOT: (Taylor) tape 7, t.c.: 7:06:06, time: 33 Secs</p> <p>OKAY, SPEED, A LITTLE BIT QUICKER WOULD BE NICE. MORE DURABLE PARTS, BUT THE ONE THING WE DO NEED TO KEEP IS THE CAST ABILITY,</p>
<p>Scene: 66 "Casting guys" working near oven 07.20.19 07.20.30</p>	<p>WE NEVER HAD ANY PROBLEMS GETTING IT THROUGH THE AUTO CLAVE, MELTS OUT REAL CLEAN, YOU KNOW OUR CASTING GUYS LIKE IT A LOT, THOSE ARE THINGS WE HAVE TO KEEP, MAYBE GET UP TO 95% RELIABILITY ON THE MACHINES.</p>
<p><u>BACK TO WALT</u></p>	<p>RIGHT NOW I'D SAY WE'RE ABOUT 80, 85, BUT IT ITS WORKING GOOD, WE, IT'S BEEN REAL GOOD, WE GET PARTS REAL QUICK.</p>
<p>FADE TO BLACK</p>	
<p>Scene: 67 Z/O from computer screen to Genisys. 11.01.04 PULL OUT OF BOX 12.01.47</p>	<p><u>Narrator (VO):</u></p> <p>WHEN U T AUTOMOTIVE IN DEARBORN, MICHIGAN, BEGAN LOOKING INTO CONCEPT MODELERS, * DESIGNERS WANTED A UNIT THAT WOULD SHORTEN DEVELOPMENT TIME, REQUIRE MINIMAL TRAINING AND WOULD FIT RIGHT IN THE OFFICE. * ONE OF THE MACHINES THEY USE IS THE GENISYS FROM STRATASYS.</p>
<p>Scene: 68</p>	<p>SOT: (Topolewski) TAPE 10, t.c.: TIME: 35 secs</p> <p>DELETED FIRST PART, NEW IN AT 10:04:45:20</p>
<p>Scene: 69</p>	<p>IT FITS RIGHT ON A DESK TOP, IT DOESN'T TAKE ANY MORE SPACE THAN A DESIGNER WOULD, THE STEREO LITHOGRAPHY AND OTHER EQUIPMENT YOU NEED</p>

<p>FONT:</p> <p>John Topolewski</p> <p>Principal Engineer</p> <p>PDC & Advanced Development</p> <p>United Technologies</p>	<p><i>A SPECIAL ROOM AND IT TAKES MORE TRAINING TO USE IT.</i></p>
<p>Scene: 70</p> <p>Computer screens</p> <p>11.02.10</p> <p>11.01.18</p>	<p><i>THIS ONE HERE WE HAD VERY LITTLE TRAINING. WE HAD MAYBE A FOUR HOUR SESSION WITH THE PEOPLE WHEN THEY SET IT UP TO TAKE US THROUGH THE PROGRAM AND * WE'VE GOT FOUR OF OUR DESIGNERS CAPABLE OF DOING IT AND AS NEW PEOPLE COME ON BOARD WE'RE ABLE TO TRAIN IT</i></p> <p><i>IN-HOUSE WITHOUT GOING OUTSIDE FOR TRAINING.</i></p>
<p>Scene: 71</p> <p>12.02.27</p>	<p><u>Narrator (VO):</u></p> <p>GENISYS IS A 3-D PRINTER THAT ALLOWS A DESIGNER TO PRINT CONCEPT ITERATIONS DIRECTLY FROM A WORKSTATION.</p>
<p>Scene: 72</p> <p>A time elapse sequence of Genisys building a part with dissolves between stages to show the progression.</p> <p>11.04.56</p> <p>11.09.07</p>	<p><u>Narrator (VO):</u></p> <p>AUTOGEN SOFTWARE ORIENTS AND SCALES THE PART, SLICES THE DATA AND AUTOMATICALLY BUILDS PARTS WITH A SIMPLE POINT-AND-CLICK COMMAND.</p>
<p>11.15.02 text: 8 inch = 203 mm</p> <p>11.17.06</p>	<p>THE GENISYS PRODUCES PROTOTYPE MODELS UP TO EIGHT-BY-EIGHT-BY-EIGHT INCHES IN A DURABLE POLYESTER MATERIAL.</p>

<p>11.22.10</p> <p>12.04.42</p>	
<p>12.12.16</p> <p>Text: .33mm</p> <p>Text: 101mm per sec.</p>	<p>A CASSETTE SYSTEM, THAT HOLDS FIFTY WAFERS, FEEDS MATERIAL THROUGH AN EXTRUSION HEAD WHICH DEPOSITS A THIRTEEN THOUSANDS OF AN INCH WIDTH STREAM OF MATERIAL, AT A RATE OF FOUR INCHES PER SECOND.</p>
<p>Scene: 72a</p> <p>Pan from completed part to computer screen with part image.</p> <p>12.12.46</p> <p>ADD TEXT FOR METRIC CONVERSION</p>	<p><u>Narrator (VO):</u></p> <p>GENISYS PRODUCES MODELS TO WITHIN AN ACCURACY OF PLUS OR MINUS 13 THOUSANDS OF AN INCH. AT U T AUTOMOTIVE, DESIGNERS USE THE GENISYS ON ALMOST ALL PROJECTS AND THE BENEFITS HAVE BEEN SUBSTANTIAL.</p>
<p>Scene: 73</p> <p>Interview on camera</p>	<p>Sot: (Topolewski) tape 10, t.c.: 10:05:28, time: 35 secs</p> <p><i>IT'S ACTUALLY SHORTENED OUR DEVELOPMENT TIME. NORMALLY WE WOULD DO A DESIGN, SEND IT OUT TO GET ANOTHER PART MADE, AND THAT PROCESS TAKES ABOUT A WEEK OR SO THE OLD WAY, OTHERWISE WE CAN DO IT OVERNIGHT. SET IT UP BEFORE WE LEAVE AND WHEN WE COME IN THE MORNING WE HAVE IT.</i></p>
<p>Scene: 74</p> <p>Engineer takes part out of machine</p> <p>12.09.03</p>	<p><i>ALSO IT GIVES OUR DESIGNERS A FASTER CHANCE TO COME UP WITH DIFFERENT CONCEPTION OF PARTS DIFFERENT GENERATIONS WE'VE GONE THROUGH AND WE'LL DO TWO, THREE, FOUR GENERATION, RUN THE PARTS OVERNIGHT AND THEN SIT DOWN AT THE DESIGNER VIEW AND GO THROUGH WHICH ONE IS THE BEST FOR</i></p> <p><i>THE APPLICATION.</i></p>
<p>Scene: 75</p> <p>W.S. of Genisys building a part</p>	<p>Sot: (Topolewski) tape 10, t.c.: 10:10:54, time: 18 secs</p> <p><i>WE HAVE OUR GENESIS MACHINE SEATED RIGHT IN WITH OUR DESIGN AREAS. IT'S NO LOUDER THAN THE OLD PEN PLOTTERS USED TO BE. EVERY NOW AND THEN YOU'LL HEAR THE FAN TURN ON TO CLEAR OUT THE</i></p>

12.01.28	<i>HEAT FROM WITHIN THE COMPARTMENT BUT THE MOVEMENT OF THE SLIDE AND EVERYTHING IS JUST LIKE A REGULAR PEN PLOTTER.</i>
Scene: 76 Interview on camera	<i>Sot: (Topolewski) tape 10, t.c.: 10:05:38, time: 34 secs</i> <i>THIS HERE IS ONE PROJECT THAT WE USE WILL SHOW YOU THE DIFFERENT INNOVATIONS WE WENT THROUGH AS OUR DESIGNER USED IT TO DEVELOP THE PART. WE GOT REQUESTED BY ONE OF OUR CUSTOMERS TO ADD A SPLASH SHIELD TO THIS CONNECTOR. IT'S FROM ONE OF OUR COMPETITORS AND GETTING DETAILED PRINTS FROM THIS AREA IN HERE WAS QUITE HARD TO DO. SO OUR DESIGNER WAS ABLE TO GET A PART, TOOK SOME MEASUREMENTS OFF OF IT AND THEN HE'D START DESIGNING IN STAGES.</i>
Scene: 76a Dissolve to continuing interview on camera	<i>Sot: (Topolewski) tape 10, t.c.: 10:08:17, time: 10 secs</i> <i>AND THIS ENDED UP GOING TO THE CUSTOMER FOR A FINAL REVIEW WHICH WAS ACCEPTABLE AND THEN FROM THERE WE WENT TO THE TOOL VENDORS WITH THIS MODEL.</i>
Scene: 76b Dissolve to continuing interview on camera	<i>Sot: (Topolewski) tape 10, t.c.: 10:09:02, time: 19 secs</i> <i>THIS HELPED US NOT ONLY IN DEVELOPING THE PART BUT HELPED THE TOOL VENDOR IN DEVELOPING HIS TOOL BECAUSE HE FOUND AREAS THAT THE DESIGNER MISSED THAT CAUSED TOOL LOCKS THAT IF THE TOOL WOULD HAVE BEEN BUILT WE WOULD HAVE PROBABLY WOULD HAVE HAD TO SCRAPPED OR HAD A LONGER TIME TO BUILD THE TOOL INSTEAD OF CATCHING IT ALL UP FRONT INSIDE OF THESE CONCEPT MODELS.</i>
Scene: 76c Dissolve to continuing interview on camera	<i>Sot: (Topolewski) tape 10, t.c.: 10:10:05, time: 23 secs</i> <i>IT'S KIND OF HARD TO SAY WHETHER WE HOW MUCH WE ACTUALLY SAVED IN COST... SOME PROJECTS WE'VE HAD WHERE THEY'VE GONE THROUGH AND WE'VE HAD NO SCRAP TOOLING OR ANYTHING BECAUSE OF THE NATURE OF THE PROJECT. ALL I DO KNOW IS THE TIME IT TOOK US TO GO FROM CONCEPTION TO KICK-OFF TOOLING I WOULD SAY WE SAVED ABOUT FOUR WEEKS.</i>
<u>FADE TO BLACK</u>	

<p>Scene 77</p> <p>W.S. Z Corporation machine</p> <p>12.17.52</p>	<p><u>Narrator (VO) :</u></p> <p>THE POPULARITY OF CONCEPT MODELERS CONTINUES TO BUILD WITH MORE BEING SOLD EACH YEAR. IN 1997 THE Z CORPORATION, FROM SOMERVILLE, MASSACHUSETTS, INTRODUCED A COMPLETELY NEW CONCEPT MODELING MACHINE.</p>
<p>Scene: 78</p> <p>C.U. of the Z-402</p> <p>12.15.05</p>	<p><u>Narrator (VO) :</u></p> <p>THE Z-402 USES THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY'S 3-DIMENSIONAL PRINTING TECHNOLOGY. 3-D PRINTING USES A PRINT HEAD TO SELECTIVELY SPRAY DROPS OF BINDER ONTO LAYERS OF A STARCH-BASED POWDER.</p>
<p>Scene: 79</p> <p>Another angle of the Z-402</p> <p>12.14.16</p>	<p><u>Narrator (VO) :</u></p> <p>ONCE BUILT, THE PART IS LIFTED OUT OF THE SURROUNDING POWDER AND CLEANED OFF. TO STRENGTHEN THE PART FOR HANDLING, THE OPERATOR WILL THEN DIP IT INTO A BATH OF WAX OR EPOXY. THE PART CAN BE POLISHED TO A SMOOTH SURFACE FOR A MORE FINISHED LOOK.</p>
<p>Scene: 80</p> <p>Pan of parts from Genisys modeler</p> <p>10.23.32</p> <p>10.23.54</p>	<p><u>Narrator (VO) :</u></p> <p>WITH THE ARRIVAL OF CONCEPT MODELERS, A PROTOTYPE CAN BE INTRODUCED SOONER INTO THE DEVELOPMENT * PROCESS AND THAT WILL CHANGE HOW ENGINEERS APPROACH A PROJECT IN THE FUTURE.</p>
<p>Scene: 81</p> <p>Interview on camera</p>	<p>sot: (O'Reilly) tape 13, t.c.: 13:08:38, time: 40 seconds</p> <p><i>NOW SO NUMBER ONE, THERE IS A FUNDAMENTAL CHANGE IN THE WAY THAT THE ENGINEERING GOES FORWARD, OKAY, THAT'S ONE ISSUE AND PEOPLE DON'T LIKE TO CHANGE.</i></p>
	<p><i>THE SECOND ISSUE IS THAT IN ORDER TO REALLY GET MAXIMUM BENEFIT OUT OF THIS KIND A NEW WAY OF THINKING IT NEEDS TO BE APPLIED ACROSS THE</i></p>

	<p><i>BOARD IN ALL OF THE COMPONENTS FOR THE PRODUCT YOU'RE TRYING TO MANUFACTURE.</i></p>
	<p><i>IT DOESN'T DO YOU ANY GOOD TO PRODUCE A FRAMUS IN ONLY 5 PERCENT OF THE TIME IT USED TO TAKE IF ALL THE OTHER WIDGETS ARE STILL TAKING THE SAME TIME THEY ALWAYS TOOK. THERE ISN'T ANY BOTTOM LINE BENEFIT TO THAT.</i></p>
<p>Scene: 82</p> <p>Concept modeler completing a part.</p> <p>Pan of prototype parts</p> <p>10.26.00</p> <p>10.24.44</p>	<p>sot: (O'Reilly) tape 13, t.c.: 13:11:30, time: 20 seconds</p> <p><i>SO I DON'T THINK ENGINEERS ARE, ONCE THEY'RE EXPOSED TO IT AND ONCE THEY CAN SEE WHAT IT CAN DO I DON'T THINK THEY'RE RELUCTANT TO USE IT. I DO THINK THAT MANAGEMENT AND COMPANIES DON'T QUITE UNDERSTAND HOW ITS GONNA CHANGE THE WAY THEY DO BUSINESS, HOW THEY WILL BENEFIT FROM IT AND AS A RESULT THERE'S A RELUCTANCE THERE TO SPEND MONEY ON WHAT MAY BE JUST ANOTHER TECHNOLOGICAL TOY.</i></p>
<p>Scene: 83</p> <p>Interview on camera</p> <p>Possibly use some of the casting footage from Union Special</p>	<p>sot: (O'Reilly) tape 13, t.c.: 13:20:38, time: 21 seconds</p> <p><i>WHAT EFFECT IS THAT GOING TO HAVE ON THE ENGINEERING PROCESS? WELL, I THINK IN ONE INSTANCE IF YOU'RE THINKING ABOUT HIGH VOLUME MANUFACTURING IT NOW IS ALMOST FOR FREE THAT YOU CAN ALONG WITH WHEN YOU'RE DESIGNING THINGS START WORRYING ABOUT WHAT IT'S GONNA TAKE DOWN HERE TO MANUFACTURING THIS THING IN HIGH VOLUME.</i></p>
<p>Scene: 84</p> <p>Shot of Steve's hands holding a part from the Genisys modeler</p>	<p>sot: (O'Reilly) tape 13, t.c.: 13:23:05, time: 43 seconds</p> <p><i>IN A SENSE YOU CAN EXTEND THAT TO THINGS LIKE SERVICE, YOU CAN START BRINGING SERVICE GUYS IN AND SAY LOOK HERE'S WHAT IT'S GOING TO LOOK LIKE CAN YOU GET AT IT? WHAT'S IT GONNA COST?</i></p>
<p>Scene: 85</p> <p>Interview on camera</p>	<p><i>YOU KNOW I MEAN ALL THAT STUFF I THINK GETS FACILITATED BIG TIME BY HAVING CONCEPT MODELERS AND THEN THE DOWN STREAM STUFF AND WHAT'S REQUIRED NOW IS THAT THE PROCESS ACCOMMODATE THAT AND BEGIN TO TAKE ADVANTAGE OF IT AND I</i></p>

	<p><i>DON'T THINK IT'S DOING IT TO A WHOLE.</i></p>
	<p><i>IT'S HAPPENING NOW ON ISOLATED CASES WHERE IN FACT ENGINEERS HAVE THIS TECHNOLOGY BUT THOSE ARE ONE OFFS IT HAS NOT BEEN ELEVATED AND INSTITUTIONALIZED INTO A NEW PROCESS AND THAT'S WHAT'S GOT TO HAPPEN NEXT.</i></p>
<p>Scene: 86</p> <p>Engineer CLEANING MODEL AT TI</p> <p>WIRE GROUP FROM TI</p> <p>TOOLING SHOT FROM TI</p>	<p><u>Narrator (VO):</u></p> <p>WITH A PROTOTYPE SO QUICKLY AVAILABLE, ENGINEERS ARE FREE TO EXPLORE MORE DESIGN OPTIONS. HAVING A PRODUCTION PROTOTYPE IN HAND FOR REVIEW MEETINGS, DESIGN ENGINEERS CAN BEGIN TO BUILD STRONGER LINES OF COMMUNICATION WITH MANUFACTURING ENGINEERS AND THE REST OF THE COMPANY.</p>
<p>Scene: 87</p> <p>Prototype parts</p>	<p><u>Narrator (VO):</u></p> <p>WHEN AN INEXPENSIVE, 3-DIMENSIONAL MODEL OF A PART IS CREATED AT THE BEGINNING OF PRODUCT DEVELOPMENT, THE RESULT WILL HAVE A RIPPLE EFFECT ON THE ENTIRE DESIGN AND MANUFACTURING PROCESS.</p>
<p>Scene: 88</p> <p>C.U. concept modeler creating a part.</p>	<p><u>Narrator (VO):</u></p> <p>IF YOUR ORGANIZATION USES A CONCEPT MODELER, BE PREPARED FOR A REDUCTION OF YOUR PRODUCT DEVELOPMENT CYCLE, POWERED BY A CLEARER UNDERSTANDING OF EARLY DESIGN GEOMETRY AND THE LUXURY TO TAKE RISKS.</p>
<p>Scene: 89</p> <p>Standard close & Credits Fade to blue and black screen background</p>	<p>Manufacturing Insights wishes to thank the following organizations for their assistance in the production of this program:</p> <p>Raytheon TI Systems</p> <p>UT Automotive</p> <p>Paslode</p>

Stratasys

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Produced by:
The Society of Manufacturing Engineers

Producer:
Steven Bollinger

Written by:
Kate Goodin

Cinematographers:
Steven Bollinger,
Jerome Cook
Preston Swigart

Video editing:
Forest Post