MEMO

To: AMP

From: GH

In Re: Findings etc

I.) Report on activity to date.

I have been conducting interviews with OEMs, Component Suppliers, Associations and State and Educational people. Most of the interviews have been conducted in Illinois, several in Wisconsin and three in Michigan. All association and state and educational institution interviews were in Illinois. All interviews have been taped. Unfortunately, as of now, only a few have been transcribed.

OEM's interviewed:

- Navistar (Purchasing)
- John Deere (Various Purchasing and training folk, also Corporate Purchasing head)
- Ingersoll Production Systems (Purchasing head)
- Caterpillar (training people only)
- Robert Bosch Power Tools (Purchasing head)
- Siemens Energy and Automation (HR)
- S&C Electric (HR)

First Tier Suppliers-Automobiles

- Eaton Automotive (Plant manager—Actuators and Sensors)
- Arvin Meritor (Corporate purchasing VP)
- ZF-Automotive-US (VP for Supply Chain Management)

Component Manufacturers

Product specialized Component Producers—Automobiles

- ITW Shakeproof Powertrain (General Manager)
- ITW Drawform (GM)
- ITW Produx (GM)
- ITW Delpro (GM)

- ITW Impro (GM)
- ITW Chronotherm (Business Unit Manager)
- Omron Automobile Electronics (HR, Shift Foreman, Purchasing)

Product specialized Component Manufacturers—non automotive

- Walterscheid (HR, Deere Rep)
- Weasler (HR, Manufacturing Head)
- ASK (Owner)
- SealMaster (HR, Plant manager)
- AMG (Finance Guy)

Process Specialized Component Manufacturers—non automotive

- Tibor (Plant Mgr/GM)
- Morton Metalcraft (Mfg, Engineering, 2 HR/training people)
- Ataco Steel-(GM-Owner)
- Signcraft (Owner, HR, Attache)
- E.J. Baseler (Owner)
- Aurora Metals (Owner)
- Triton (Owner)
- Modern Die Casting (Owner)
- Hi-Grade Manufacturing (Owner)
- Lorine (Two Owners)

Other Component Producers

- Josh Whitford and I attended at day long meeting between John Deere Construction Equipment people and about 20 of their most important suppliers. Not exactly an interview; not useless.

Other:

- UAW—John Deere

Associations:

- Valley Industrial Association (President, Training program head)—Suburban manufacturing association very involved in training
- NORBIC- (President, Program Head)-north Chicago manufacturers association. Sort of a not for profit consulting group. Does training

- Illinois Manufacturers Association (Training Program Head)

MEP

- Chicago Manufacturing Center

State Government

- DCCA-ITA (Program Head)

Education & Training

- IIT-Manufacturing Technology and Manufacturing Productivity Center
- Chicago Workforce Development Project
- Economic Development and Training Unit at Great Cities Institute

II.) FINDINGS:

The following memo summarizes field interview data collected in the summer and fall of 2001. It has been purged of all specific references to interviewed firms—examples have been given pseudonyms. Any non fictitious references involves public information about very large firms available in their own literature or in the press. The most significant findings are enumerated below under the following headings:

- OEMs & Suppliers (decentralization & lean production): ¶ 1-6,
- Cost Reduction: ¶ 7-18
- Strategy & Market Structure in components supply (Diversification, Specialization): ¶ 19-34
- Component manufacturers & their own suppliers: ¶ 36
- Work and Production Organization/Training Issues ¶ 37+

1.) **OEMs & Suppliers:** All OEM's interviewed (including tier one suppliers)except one are decentralizing production, focusing on a small number of core competences, purchasing increasing amounts of value added, and collaborating on product design with (some) suppliers. Collaboration on product design frequently means giving the supplier a black box and then working with them on the best way to insert that box into the rest of the design and engineering of the product. There is a lot of talk about modules, where the supplier gets a very big box—an entire sub system of the car—but there are few eg's of this in practice: Some of the German transplants in Alabama and South Carolina, and now apparently the new Ford models to be assembled in Chicago. But modules are still something for the future, not the present.

2.) OEM's are under a lot of pressure from competitors and from the stock market to make their operations more efficient. They require absolute perfection on quality, and very efficient suppliers. Inventory is being progressively squeezed out of the entire production chain—in some respects it is being shifted downwards, but increasingly suppliers themselves are adapting methods that allow them to get rid of inventory. ISO/QS reporting techniques, cellular manufacturing, kaizen, systematic benchmarking, root cause analysis are all diffusing widely. Firms are preoccupied with reducing WIP, improving quality and getting rid of inventory. Virtually every firm interviewed , in autos and not in autos, claimed that perfection on quality had become a taken for granted in their industry. It was not possible to participate in bidding if the quality was not there.

3.) This has had interesting consequences for the institution of supplier development in OEM's. It seems that in Automobiles and other high volume manufacturing sectors (such as power tools) the discourse of low inventory, high quality, lean manufacturing etc had been around for nearly fifteen years. There was a period in which OEM's and First Tiers considered it to be useful to develop their own in house production consultants to help/instruct/force their suppliers into the adoption of leaner and more efficient forms of organization and practice. This period seems to be over. Firms basically assume that there are enough firms out there in the economy—in the US economy—who can produce in this way that they do not need to spend their own money to help them come around.

4.) This seems to be less the case in lower volume industries such as Ag equipment and construction machinery. Here the shift to low inventory, perfect quality production is more recent and the major firms sustain their own in house supplier development corps. Truck producers seem to do this a little bit as well.

5.) Most of the component firms I spoke with had either already implemented "lean" techniques (true of all auto suppliers) or were in the process of doing so. This was especially true of cellular manufacturing. People were implementing it where they could and were trying to figure out why they could not get rid of functionality where it seemed intractable. Sometimes there was resistance to the new form of organization—especially at the level of the plant manager—and sometimes there was not enough volume or enough coherence or enough complexity in the product palette of the firm to justify (or design) cellularity. In one or two cases, the shop was so small that it basically constituted a cell.

6.) There were a few hybrids where the company had some cells and some functionally laid out areas that fed several cells, or that received pieces from cells to assemble. In these cases you didn't get a sense that this was transitional, but rather that they were doing their own thing and that it was working for them—not that they would not keep trying to improve!

7.) **Cost Reduction:** In general pressure by OEMs for regular cost reductions on the part of their suppliers was found everywhere. The pressure was probably more intense in the high volume industries, especially Automobiles, than in the batch production industries. But pressure for cost reduction was mounting in the latter industries as well, particular at Deere and other construction/Ag producers. Increasingly, finding ways to continually reduce costs for your customer is an inescapable part of manufacturing practice. There are fewer and fewer places to hide from this pressure.

8.) Because annual cost reduction has become non negotiable, at least in autos, dialogue between supplier and customer has developed about what kinds of adjustments can be made, on both sides, to achieve reductions. Significantly, this does not have to translate directly into wage reductions or even to immediate changes in the organization of production in the supplier firm. Reductions can also be achieved, eg, through the cooperation of customer and supplier to gain leverage on raw materials purchases OR by redesigning the interface between supplied part and its environment OR by changing the details of delivery conditions OR by giving the supplier business in a new area in exchange for a price reduction in an older area. The possibilities here are very nearly limitless.

9.) Savings can also be had in areas completely outside of production, and do not have to be located in the supplier firm. Eaton, for example, outlines a very broad array of areas in which it is willing to negotiate with its suppliers in the search for cost reduction. These are presented as "Thought Provokers/Enablers" in its pamphlet on cost reduction: "IDEAS: Innovation Drives Excellence, Achievement and Savings" and they are:

Product Design

s Content
s Design
s Materials
s New Technologies
s Optimization of Validation or Test Requirements
s Reliability
s Recyclability

Manufacturing Improvements

s Cycle-time Reduction
s Inventory Reduction
s Process Improvement
s Volume Efficiencies
s Tooling

Business and Administrative Improvements

s Payment Terms
s Communication
s Eaton Administrative Practices
s Complexity Reduction

Logistics

s In Bound/Out Bound Freight
s JIT Delivery
s Packaging
s Re-Usable Containers

Sourcing Strategies

s Integrated Supply Base
s Supplier Optimization

Quality

s Warranty
s Other Cost of Quality
s Local Quality Initiatives ($10,000 credit/location)

10.) Eaton suggests that each of these areas are fair game in the search for cost reductions and that suppliers should work with Eaton people in all of these areas in order to find possibilities for cost reduction. The document I copied from above outlines the procedure that Eaton wants suppliers to follow. But the point is that “cost reduction” is a very robust concept and there are many many different ways in which firms can strategize to be able to achieve it beyond the reduction of wage costs or the reorganization of production narrowly conceived. Increasingly, since producers are pretty lean, strategies for mutual discovery of cost reduction opportunities have become very creative. Suppliers have to spend a great deal of the year plotting and scheming and searching for ways in which they will be able to come up with the reduction in the next year.

11.) The entire process of searching for possible workable cost reductions is a kind of waltz. Firms have to be willing to do the dance—if they are not, they are cut out. OEM’s turn to other suppliers if acceptable terms for cost reduction wind up not being possible to agree on and suppliers will get rid of an OEM which over time acts in bad faith, or refuses to negotiate in its demands for cost reduction. The idea is to look for workable and mutually acceptable arrangements –at Arvin Meritor the term is “Mutually Beneficial Cost Reduction”--that make further dialogue possible—no beggaring thy neighbor or supplier if good faith is involved in the process of negotiation. The ability to collaborate with the customer over the discovery of cost reduction opportunities is itself a competitive advantage. It makes the OEM more interested in dealing with the supplier in subsequent rounds. Competition, conflict and cooperation all run together here—not clear that it should be called trust. But it is clearly neither a spot market relationship nor a dictated, autocratic relationship of unidirectional power.

12.) It is important to not put too happy or cozy a face on this. In Autos, OEMs have regularly reached points in their financial situations where they refuse to participate in the dance and simply unilaterally demand five percent (or whatever). No negotiation. Daimler Chrysler did this this summer. GM did it a few years ago. A lot of suppliers think that Ford might do it soon given its current troubles . But to a firm (including the first tiers), none of the suppliers expected this kind of strong armed no negotiation technique to be a long term feature of their relations with customers. They view it as an occasional exception—driven by a crisis in quarterly numbers. They also, however, understand it to be an inevitable, regular feature of the business. They have to cooperate with their customers and regularly, now and then, suffer being screwed by them. This is the auto business as far as they are concerned.

13.) But the Screwing goes deeper than that. Most OEMs (and first tiers) will pursue strategies to make their suppliers nervous—not take for granted that business is safe. They cultivate suppliers in low wage markets (Mexico, China, Asia generally), even as they continue to source similar products from domestic producers. They show designs and development work done by suppliers to their competitors—in the Bosch Power Tools case, in a decent German way, they wait one year and then do it, in every case. OEMs are constantly testing suppliers, trying to keep them on their heels, in order to stave off complacency and ensure good faith efforts on the part of suppliers to find ever new and more creative ways to reduce costs. Miraculously, this does not interfere with the OEM's interest or ability to engage in collaborative relatively open negotiations with suppliers.

14.) Basically, OEM's, including the First tiers, want to cultivate as many possible options and strategies for reducing costs as possible—to the extent that there is a trend, this is it. Whatever they do in a particular case will depend a lot on the situation, the alternative options available, the creativity and quality of the supplier etc. Significantly, since OEM's are cultivating a broad array of options for cost cutting, it is also occasionally possible for them to cut a supplier a break—not take a cost reduction for one round, take less than they wanted—etc and pick up the slack in some other way. But this is always done in return for something.

15.) The point, though, is that OEM's and First Tiers in the Auto industry are actively collaborating with their suppliers, not only on technological and product related matters, but also (and in many ways indistinguishably) on cost reduction issues. The OEMs rely tremendously on pre-existing know how and quality of production in their supply base. There is very little fear among suppliers who are able to engage in the dance I have been describing that OEMs in some way are moving inexorably out of domestic manufacturing. Suppliers seem confident that if there is work to be had at all, domestic suppliers will get their fair share of it. This was as much true of the Auto suppliers I spoke with as it was of the batch producer suppliers.

16.) There is a slight difference between sectors on the pressure and intensity of cost reduction: Autos are very intense. Other sectors with lower volumes less intense. In the latter case, some of our interviewed firms were as a result able to hold the line on price reductions—not give them. Such firms tended to be very broadly diversified and in a position to say no without it hurting too much . In general, more diversified process specialists and/or somewhat larger players with a product niche or patented product were more secure and could negotiate from a stronger position than were those process specialized firms with greater dependence on a single customer or firms with a commodity product, or ones with many other comparable competitors.

17.) Leverage is a relative thing. The space between complete leverage and autocratic power on the part of the OEM and the ability of a supplier to absolutely refuse to respond to demands for cost reductions is vast. Participation in the middle area is often strategically beneficial even for those who can impose their will or resist. The cost reduction waltz noted above, because it brings customer and supplier into dialogue about their interactions and how much they cost, often brings to light possibilities for cost reduction on both sides that have wider applicability within each firm and which could not have been identified without the interaction between the two firms.

18.) Even in those cases where the structure of leverage seems to lean heavily in the direction of the customer, the customer often prefers to engage in the process of negotiation over cost reductions rather than act unilaterally: A supplier that can consistently make good suggestions about cost reduction (and technology/product design etc) is very valuable. The customer is likely to act in ways that will allow that firm to continue to make money—give it advanced warning of design changes, heads up on new product launches etc. This is least likely to occur in "commodity" product areas, but even in those areas, if there is a good quality supplier, firms will negotiate for cost reductions rather than play a simple spot market substitution game—the pay off is higher on both sides.

19.) **Strategy and Market Structure:** Among suppliers in both the high volume auto sector and in the mid and low volume sectors, there seem to be two broad strategies that firms are adopting: diversification OR specialization.

20.) The logic behind the pursuit of a diversification strategy is that OEM's want their suppliers to do more. OEM's want more sub assemblies and would like to one stop shop on a series of operations—cutting and stamping, plus welding, painting etc. Some suppliers attempt to bring in additional functional capacities to be able to offer more to the customer. If, however, every customer does not want all the operations on every order or with every product, the diversified firm tries to keep the various machines running in a job shop manner—"we will take any work we can find to keep things going". Hence they have the capacity to bundle and integrate on a product level, but can also pursue independent strategies on a process or functional level.

21.) At the largest level, and primarily at the level of products, this is what a lot of first tier suppliers are doing. They believe that OEM's are going to be sourcing entire modules so they want to be able to "cover as much real estate" on the module as possible. The view is that an OEM doesn't want to look around for specialists who will collaborate on the module and they don't want to have to trust this hunting around to a first tier. They would rather have the first tier be able to provide all the stuff, and have considerable size, so that they can provide all the appropriate emergency stuff—liability, recall capacity etc. But first tiers who believe in this logic also insist that this "cover the real estate" strategy is consistent with continued decentralization or outsourcing of production to specialized component suppliers. "We would only do what we viewed as our core competence in each technology in house and purchase the rest".

22.) At the first tier level, this drive to cover enough real estate to be considered a viable module producer seems to have lead to a lot of overreaching. There has been a notable recent bankruptcy (Federal Mogul) and a lot of the other American majors that expanded dramatically in the last five years in anticipation of modules are teetering on the edge of chapter eleven—Dana, Tenneco for eg. Others, such as TRW, are such a nightmare for their parent conglomerates that the parent is trying to sell them.

23.) But, the point with respect to diversification is that in most cases, even though the first tiers talk the module talk, they wind up still mostly selling components. So they have the real estate covered, but they sell most stuff independently. Lots of debt and not much revenue from this strategy so far.

24.) At the more modest level of the low volume metal shop selling parts to John Deere or Caterpillar, the diversification strategy might make a little bit more sense, because it winds up being process diversification and not product diversification. Properly managed, the strategy could conceivably push the firm in the direction of the development of its own proprietary product. (Though I have not seen any serious examples of this—maybe some hints). Having a number of processes that it can run in house, however, makes it possible for the firm to diversify its customer base. Job Shop X in a Chicago suburb is a good eg of this. They expanded over the last fifteen years from a focus on complex welding to stamping and milling operations. Very little of the business that Job Shop X does involves the integration of all three operations. But having those three bases allows them to limit the amount of work that they do for any given SECTOR to 15% of total annual output. They haven't had a bad year for 15 years , currently are holding the line on prices and are working full shifts today.

25.) The risks associated with diversification at the small shop level are not that different from those facing the first tiers: its expensive, they may not know the new operations as well as their original ones and the "bundling" work is not as extensive or as lucrative as the firm thought. A firm can lose its focus—which can be bad in the context of constant demands for creative cost reduction suggestions. Or simply not know the market for the new process or how to manage it properly. Family Firm Y in western Illinois purchased a metal bar cutting machine and set up an independent facility in Aurora to house it and couldn't make the machine or the facility run profitably (they blamed it on the people of Aurora!). But companies like Family Firm Y seem to be in a panic about the ever insistent pressure to cough up new cost reductions from Deere at least in part because they had so much differentiated stuff going on that they can't keep it all tightly under cost control (not that they didn't also have legitimate gripes about JD—but I will leave these stories to Josh).

26.) BUT, diversification into new areas, small companies building up fixed capital debt and learning new markets and processes can also lead to the pathology of buying business. Firms need work to learn, but are not good enough to legitimately compete with other process specialists. Without work, they can't learn, so they buy the work by under bidding on jobs. Job Shop X freely admitted to having done that when it was developing its machining center business. Under bidding and buying business is done no doubt by uncompetitive firms in all sectors of the components business. But there is a structural tendency toward this built in the diversification strategy.

27.) The other strategy one finds is specialization. The most successful cases are those in which firms specialize on a particular product. Specialization on a process is more risky – it sort of depends on the process you specialize on.

28.) The most successful component supplier firms I visited were specialized on a particular product with a strong niche. This principle of niche specialization is the credo of the ITW auto supply group of companies. Each of the units of ITW is independent—they make their decisions about product, technology, labor, whether or not to buy another company or to spin off a part of themselves (which they do all the time) entirely locally. ITW corporate is a holding company with a tech center attached to it. There are two layers of management between the head of the whole shabang and the GM of an operating unit in the auto area. ITW owns 600 companies and expands by 40 companies a year—and not all of those companies are acquisitions; many are spin offs that result from the break up into smaller specialized units of previous ITW entities. The company has this mantra principle that a company should constantly do a so-called 80/20 analysis: 80 percent of revenue and business will always come from 20 percent of your operations. Firms should focus on the 20 percent and get rid of the other 80% of their operations. Doing this analysis constantly leads to splits in operating companies, the creation of new focused factories for specialized products. The company basically applies the principle of cellular manufacturing as a way to run a manufacturing conglomerate.

29.) The advantage of this kind of specialization—which is always on particular component products with a very competitive functionality in the auto—is that it drives efficiency in production to very extreme levels. At the same time, in Smithian fashion, the firm believes that specialization focuses the mind and fosters innovation. Having very extreme risk that comes with the specialized focus is also an incentive for continuous improvement and search for tech innovation. Firms are constantly embracing specialization and greater risk, but they also rely on a fair amount of information and tech exchange among the independent units (most of the GM's and engineers have worked together in the past at some historically common ancestral ITW company (of the companies interviewed listed above, only Chronotherm and Drawform were not a descendant of Shakeproof, for eg). Also, each ITW member company pays an annual fee for unlimited access to the corporate tech center. Most use it on a regular basis. So, like an industrial district, ITW companies are very flexible and specialized, and endure a lot of risk that comes from extreme specialization, but they also rely on an exoskeleton of open exchange and corporate tech support that makes it easier to deal with the risk.

30.) The independent specialist companies that I visited were not as extreme in their specialization as the ITW member units. Most, such as Specialist 1 or Specialist 2 or Specialist 3, were specialized on specific kinds of component subassemblies—clutches or heavy duty ball bearings or whatever those ball joint things are that you find on aq accessories that drive things. Each of these firms had an array of related products that they could offer or adapt or design specifically for their customer. But it was bounded within a clear area of specialization and involved a very specific kind of product, the market for which they were dominant players in. None of these companies were very interested in expanding what they did into other related technological areas. They were making their money making heavy duty ball bearings and it was their agenda to keep themselves innovative and flexible enough within that area of specialty to stay close to the top of the market.

31.) Of these companies, Specialist 3 and Specialist 2 were members of larger conglomerates (Emerson Electric and GKN respectively) and could as a result draw on training and tech support from its corporate parent. Specialist 1 was an independent, yet seemed to live with the risk of specialization through very close attention to the needs of the customer and openness to info and experiences of other specialists in the region and in its business—it was a spirited participant in WSTC, for eg.

32.) Specialists on particular processes were more mixed in terms of their health and success. One firm, Wisconsin Family Firm, which specialized on deep stamping was pretty successful because its process was relatively complex, required very expensive machinery and dies and involved smaller volumes. Thus not a lot of stamping houses would want to make the investment. The company was a strong player in the national market and was even able to hold the line on its prices with its customers. Half of its plant and equipment were destroyed in a fire two years ago and the company still made money that year.

33.) Interesting about that firm, though, was that they were in very close touch with a variety of other stamping houses, both their own competitors and houses with machinery a tad smaller than their own. After the fire, they were able to continue to fulfill orders by getting these other firms to take the business. There was a lot of info, customer, tech sharing in their business. They got a lot of useful service out of the PMA, for eg. This spread a bit of the risk that they incurred from specialization—or at least gave them an infrastructure of experience and capacity that the firm could draw on in a pinch.

34.) This same kind of information and tech or process ideas sharing also existed in another process specialist business that Josh and I visited—Chicago Family Screw—a screw machine shop. This was a family company that basically knew only screw machining. They were more vulnerable in the market and vis a vis their customers than Wisconsins Family Firm or Specialist 1, but they were committed to specialization (or maybe they were stuck there). In any case, they made it work not only by paying very close attention to their customer's needs, but also by sharing info and sometimes customers with a group of other screw machine shops in Chicago—all family firms, all second generation.

35.) I don't know how far I want to go with this specialization versus diversification contrast. Both strategies have strengths. But it was interesting how successful and how reliant on outside help the specialists were. There also seems to be less structural vulnerability to low ball bidding practices in this business—aside from the inevitable temptation to do so in down markets where you want to get business to keep your people and run your machines.

36.) What about component manufacturers and their own suppliers? In a lot of cases, the firms I interviewed were at the bottom of the food chain. They bought some raw material and that was it. Basically they dealt with commodity suppliers of steel and other metal. In some other cases, however—several of the ITW companies, Family Firm Y – the companies did buy important inputs from outsiders and on the whole they had very close and cooperative relations with those suppliers: They developed things jointly, they found them work, they tried to protect them from the cost reduction pressure that their own customers were pressing on them.

37.) **Production Organization, Skill and Training:** Firms were remarkably similar on these issues. As noted above, cellular organization was on everyone's minds—either they had done it or they were trying to figure out how to do it. Most metal component firms had the following job hierarchy: Operators, Setup-Operators and Technical Maintenance people. Many firms also had some toolmakers who were very highly skilled and also loading dock and warehouse people who were not so highly skilled. On the core production hierarchy, the operators were the least skilled—basically could be brought up to speed on a single machine within a week. If they were crossed trained it would take a bit longer. Set up involved significant training in programming and blue print reading and in the principles of machining. Some places kept set up separate from the operator function, most places combined the jobs. Technical maintenance was a very highly skilled job that involved not only knowledge of how to run and set up machines, but also how to service them and repair them.

38.) I don't have any specific hypotheses about how particular arrangements in skill distribution are determined. In most places, firms wanted to have their people cross trained—so they could hire fewer people—so they were willing to train them to be able to do so. It was convenient to have the operators trained enough to do set up. Becoming a technical maintenance person was much more difficult and there were only a few of those positions in any particular plant. Those jobs were at a premium. But basically everywhere, if you worked long enough at the company—eg made it through a year—the company in one way or another tried to get you some training so that you could deal with the machines. Indeed, it was very frequently the case that the firm used temp agencies to supply it with operators who they could test out (and easily fire). If they liked the person, they would hire them on permanently and then try to train them into the setup skill area. Going higher than setup was more difficult and more expensive. Its also the case that the infrastructure for this jump in training from set up to technical maintenance is very under developed—in part because the "skill" in set up doesn't require a lot of outside formal training. It is often a fine firm specific mix of formal knowledge (blue print reading etc) and equipment specific knowledge. Technical Maintenance requires some schooling and the school infrastructure in Illinois for this stuff is pretty underdeveloped.

39.) But in the absence of a better hypothesis, I would say that the general impression one gets is that firms try to train workers up to a certain level of competence to ensure flexibility and help with the cost reduction process(and to save on labor costs—hire fewer people). Cross training is favored by cellular organization and set up knowledge cuts down on down time and changeover times. Workers trained and knowledgeable of a larger portion of the process are in a better position to make suggestions as to how things might be changed to contribute to cost reduction.

40.) In Chicago and the suburbs, on average an operator starts at \$8-\$9/hr and can go up to \$11 or so with a few years experience. If you learn set-up you could make between \$14 and \$18 (if you had a union). Most tech maintenance and tool and die people made closer to \$20/hr—plus overtime etc. In lots of job shops you have demand for certain very archaic skills—how to run a screw machine built in the 1970s. These tend to be very highly paid positions and are dominated by old white (sometimes native European) men. They make over $20 plus a lot of overtime. There is very little training of that kind of worker taking place anymore. When they die it is not clear who is going to run those screw machines. There is training of setup operators and tech maintenance people going on though—both in house (especially in house) and in tech colleges.

41.) Interesting about the above paragraph in Chicagoland is that those numbers seem pretty indifferent to ethnicity. That is, about 40% of the manufacturing workforce in the six county Chicagoland economy is Hispanic and those workers can be found at all level of skill and are drawing wages that correspond to white or European workers doing equivalent jobs. I believe black workers make slightly less for an equivalent job—but they tend to not be very active in chicagoland manufacturing labor markets. The largest competitors with Hispanics in Chicagoland for manufacturing jobs are European immigrants—especially poles and serbs. Asians also occupy important positions in particular labor markets. Very few native white people under the age of 45 work in production in Chicagoland manufacturing. I can bring specific figures on this from the Chicago Area Workforce Development project. The training landscape in Chicago is very well studied.

42.) Peoria is more white. Rockford is more like Chicago, though slightly more white in the end. The Quad cities are also mixed, though majority white. Galena was totally white.

43.) Very few women in the production area in the manufacturing environment. Several firms had significant numbers of women, but on the whole they were primarily stuck in the operator level. Exceptions were Specialist 3 and some of the ITW companies. Specialist 3 in general was a striking firm from a high road perspective: It employed mostly setup operators or above; it was a 90% Hispanic workforce; UAW organized; did constant in house training—etc

44.) This report should by rights also discuss the whole role of associations, but in the interest of time I will leave that to our open discussions.