YFVE group headquarter is located in Shanghai, China, which covers one technical center and five manufactory plants.

We produce and deliver the automotive electronic products to the worldwide customers, and many awards from customers recognize our products.

Everything we do is to keep increasing the values added of the products and systems we provide to our customers, the value to our employees, to our shareholders and finally to our society.
There’re five plants in YFVE group and they are located in different cities near to our end customer in China. We consider the five plants as one team, and definitely, we need one platform!
Here is a list of our major products in five plants.

Cluster
CCH---Climate Control Head
Audio---Amplifier, CD Radio, Bluetooth, Navigation
ECU---Engine Control Unit
RKE---Remote Key
FPC---Fuel Pump Control Model
BCM---Body Control Model
LCM---Lighting Control Model

All plants’ products are manufactured based on customers’ needs.
Our customers are worldwide based, located in Europe, Asia and North America.

Meanwhile local customers develop rapidly because of the quick growth of Chinese automotive market. The great competition results to lots of high requirements from all customers, such as low cost, high quality, more function…

Meanwhile the growing cost of labor and operation in China will progressively drive the companies to develop and implement higher automation solutions and seek for continuous improvement on the manufacturing processes to balance those costs. It was critical to develop and implement these strategies at that time.

All these business environment forced us to change; product design and manufacturing automation is very important to us, so improving our own core technical capability is the top-priority.
Hello everyone! I'm Gina, test engineer of test department in Fudian plant. Our job is to test products to make sure we deliver qualified products to customers.
Our project is about ATE, ATE is Automation Test Equipment.

What we do is to make non-standard ATE to one standard ATE platform in Fudian plant, then replicate the platform to other plants.

It took us almost two years (from 2010 to 2011) to make the project successful! Let me show you how we made it!
Thank you Gina, I’m Siva, 6 sigma black belt. Let me go through our project---One Team One Platform from first section---Project Selection and Purpose.

This page shows us the source information, quality tools and why they were used to finalize our project.

Source of information was from internal and external stakeholder.

VOC & Survey helped information collection.
Evaluation Matrix assessed the impact of the potential projects to company goals.
Pareto indicated the top priority project.
Comparing voices of internal & external stakeholders with our current status listed, we can see the gap:

- Reduce Fixed Investment
- Improve Operation Efficiency
- Improve Technical Capability
- Improve Product PPM
- Improve Employee Satisfaction

All these gaps would be our improvement opportunity to align with our company goals, which are the criteria in evaluation matrix to evaluate all the potential project, the top priority in Pareto was ATE platform.
This table lists all potential stakeholders and how they were involved in the project selection process.

Top management defined company goal and **balance score card**. Operation provided current status and led project selection. Commercial provided business information. Other plants took part in the **survey** and passed customer’s requirements. Requirements of end customer were considered via **VOC**.

### Table: Potential Stakeholders and Involvement

<table>
<thead>
<tr>
<th>Potential Stakeholder</th>
<th>Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Management</td>
<td>- To define company goal and balance score card</td>
</tr>
</tbody>
</table>
| Operation             | - To provide current status  
                        | - To lead project selection with 6 sigma tool                                |
| Commercial            | - To provide business information                                           |
| Other Plants          | - To take part in survey  
                        | - To pass customer requirements                                             |
| End Customer          | - To provide requirements                                                   |

### Info. + Tools From 1Aa

**Balance Score Card**  
**VOC**  
**Survey**

**S1 Project Selection and Purpose**  
One Team One Platform
To achieve company’s mission, company goals were defined by top management as following:
  • Business Growth
  • High Operation Efficiency
  • High Technology
  • Customer Satisfaction
  • Employee Satisfaction

This project directly resulted in some performances, which contributed to company goals, and these performance were from company balance score card.
This slide lists the types of impact to organization goals from this project.

Our project objectives and the impacts were:
- Reduce Fixed Investment – Reduce Cost & Win more business
- Improve Operation Efficiency – Improve Efficiency & Reduce Downtime
- Improve Technical Capability – Improve Technical Capability
- Improve Product Quality – Reduce Product PPM & Improve Customer Satisfaction
- Improve Employee Skill - Improve Employee Satisfaction
1Bc. Identify the degree of impact the project will have on each goal, performance measure, and/or strategy.

<table>
<thead>
<tr>
<th>Project Objectives</th>
<th>Organization Goals</th>
<th>Impact Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce Fixed Investment</td>
<td>Business Growth</td>
<td>• Reduce Cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Win More Business</td>
</tr>
<tr>
<td>Improve Operation Efficiency</td>
<td>High Operation Efficiency</td>
<td>• Improve Efficiency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reduce Production Downtime</td>
</tr>
<tr>
<td>Improve Technical Capability</td>
<td>High Technology</td>
<td>• Improve Technical Capability</td>
</tr>
<tr>
<td>Improve Product Quality</td>
<td>Customer Satisfaction</td>
<td>• Reduce Product PPM</td>
</tr>
<tr>
<td>Improve Employee Skill</td>
<td>Employee Satisfaction</td>
<td>• Improve Customer Satisfaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improve Employee Satisfaction</td>
</tr>
</tbody>
</table>

Evaluation Matrix scored the degree of this project impact to company goals, the impact evaluation criteria was as the following:

- 9---High impact degree
- 6---Medium impact degree
- 3---Low impact degree
- 1---Weak/Slight impact degree
Top management and other plants were identified by VOC from balance score card and survey in 1Ac, they can get their interests directly from the project fruit.

SIPOC helped to identify end customer and testing, testing was the key process in this project.

Swim-lane flow chart focused on testing, which helped to find the improvement opportunities to operation, so that would be very important to the project success.
Mind Mapping guided us to find all impacts on stakeholders.

The positive impacts were almost aligning with company goals, while the negative impacts were:

- Increase Headcount for ATE Development
- High Downtime at Beginning of New ATE
- Slow Response to Other Plants
With the evaluation criteria, we scored all impacts degree with team together.

High impact to operation, testing and other plants.
Middle impact to plant manager and end customer.

We identified the degree level as high, middle and low:
- Weak (≤1)
- Low (1~3)
- Medium (3~6)
- High (≥6)
Thank you Siva, I’m Jane, project leader, let’s go to section 2---Analysis of The Current Situation, which will show you the situation we faced in 2009, and you will understand better why we do this project.

The methods and tools listed here were used to identify possible root causes.

**Trend Chart** was used to show plant investment and downtime trend.  
**Pie Chart** indicated the main investment & down time.  
**Pareto** was used to compare ATE downtime between suppliers and self-development.  
**Fishbone & Brainstorming** helped to find all the possible root causes for ATE downtime.

Following slides will give you more details on how we did the analysis.
Here was test situation in YFVE group in 2009

We only had ATE in Fudian plant and the other 4 plant's production testing was performed in manual way. But more and more customers can’t accept products tested manually without traceable data and qualified process! So apparently ATE became the road block to win more business!
The ATE situation in Fudian plant:

**Investment & Downtime Trend** told us that the fixed investment increased very fast from 2006 to 2009 to meet business expansion, especially in 2009, the investment was more than double of 2008. And obviously, the downtime ratio increased as well.

The **Pie Charts** of plant investment and downtime showed us the top one is ATE.

The **Pareto** told us that 85.9% of ATE downtime was caused by suppliers' ATE.

**Fish bone & Brainstorming** were used to find out 24 possible downtime root causes of suppliers' ATE.
Operation *provided trend* and *pie chart* of plant investment and downtime.

Testing *analyzed data* and *led to find out* the possible root causes of ATE downtime showed in previous slide by *Pareto, brainstorming* and *fishbone*, involving operators, technicians and engineers together.

Other plants *passed customer requirements* via *VOC*
FMEA and Multi-Vote were used to narrow down the all possible root causes. 5 WHY helped to find the final root causes listed as output.
Here are the analysis data:
24 possible root causes were listed in FMEA, and with Multi-Vote we get the top 6 with high score, they were:

- Different Interface
- Different Software
- Different Hardware
- Different Manual
- Poor Technical Capability
- Slow Supplier Response

Since the first 4 items can be classified to one root cause: ATE Variety, so we got:

X1: ATE Variety
X2: Poor Technical Capability
X3: Slow Supplier Response

But what was the real root cause for X1: ATE variety? 5 WHY helped to find out the real root cause from answer 4: We had no ATE Standard, so we got final root causes:

X1-4: No ATE Platform
X2: Poor Technical Capability
X3: Slow Supplier Response
Based on the previous slide, we got the final root causes were:

- **X1-4**: No ATE Platform
- **X2**: Poor Technical Capability
- **X3**: Slow Supplier Response

**Impact matrix** showed the high impact to operator, technician and engineer from ATE variety.

**Pareto** indicated 87% ATE downtime was caused by technique.

**2-Proportions Test** verified that slow response was mainly from suppliers.

The validations above proved out our final root causes.
How to develop one standard ATE platform? This question will take us into section 3---Solution Development

Firstly we developed the possible solutions with the following methods and tools:

**VOC** helped us collect the requirements from all stakeholders for ATE platform development.

**QFD** converts the VOC to possible functions of ATE platform and got possible solution who would develop ATE platform.

**Pugh Matrix** was used to choose unique software language and hardware to be developed.
VOC list all the requirements collected from internal and external stakeholders as the input of QFD. One output of the QFD were the possible functions of ATE platform. We classified all the functions into software, hardware and user manual with foundation and option:

**Foundation** supports all the products. **Option** decided by specific project.

Another output of QFD was the score from team **multi-vote** with **evaluation criteria**, the item in software and hardware foundation with high score were listed here as following:

- Unique software development language
- Hardware development

We will focus on them later.

But who will develop ATE platform? We get two options from **multi-vote**:

- YFVE
- Supplier
We identified the criteria based on **customer requirement in 1Ab and the final root causes in 2Bb** with high weight, they were: **Cost, Timing, Core Technique and Response**.

**Development Experience** was the basic requirement for ATE platform development.

The final score chose YFVE would develop ATE platform.

So the **capability we have** and **timing for development** would be the key criteria to choose unique software language and hardware development. The different criteria for software were:

- Time to understand
- Easy to make interface
- Flexible Occupancy

And another key criteria for hardware was **using frequency**

**Pugh Matrix** showed us Labview selected as the unique software development language with top score ,and the DIO, D/A and SP were selected as the hardware we would develop because they meet all criteria.

A pilot project will tell us how we selected the final software and hardware option with the criteria from the project requirement in 3Bb
**3Ba. Describe** the methods and tools used by team to select the final solution(s).

<table>
<thead>
<tr>
<th>TOOL</th>
<th>Bar Chart</th>
<th>Layout</th>
<th>Pugh Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pie Chart</td>
<td>Motion Time Analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evaluation Matrix</td>
<td>Line Balance Bar Chart</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WHY</th>
<th>• To decide a pilot project</th>
<th>• To optimize the labor and equipment balance</th>
<th>• To filter the possible functions in 3Ab</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>OUTPUT</th>
<th>✓ P32 cluster</th>
<th>➤ One final solution</th>
<th>✓ Other final solutions</th>
</tr>
</thead>
</table>

**Final Solution Selection**

**S3 Solution Development**

**Bar Pie Chart and Evaluation Matrix** decided the pilot project as output P32 cluster.

**Layout, Motion Time Analysis** and **Line Balance Bar Chart** optimized the labor and equipment balance to get one final solution.

**Pugh Matrix** filtered the possible function in 3Ab to get final solutions.
Since we had many different products, so which project would be pilot project for ATE platform development?

Based on the new project quantity in next two years and downtime contribution from different products, cluster was selected as pilot product. From the aspects of product volume, cost saving, ATE type, region and process capability with different weight, the top score in this evaluation matrix gave us the answer---P32 cluster was selected as pilot project.

Then here came the layout, Motion Time Analysis and Line Balance Bar Chart of the pilot project, the data in circle could be optimized to reduce one equipment and labor, so we got one final solution---combine ICP and motor assembly.

Here possible solutions in Pugh Matrix were from 3Ac, and the pilot project requirements would be the criteria to choose final solutions with high weight of cell size, project timing, quality and customer requirement. With the evaluated impact to the original layout:  

+ Positive  - Negative  s No impact

The final solutions came out!
### 3Bc. Describe how stakeholders were involved in determining the final solution(s).

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Involvement</th>
<th>HOW</th>
</tr>
</thead>
</table>
| Project Manager | • To introduce pilot project background  
• To collect and clarify customer requirements | • Meeting  
• VOC                                      |
| Operation     | • To provide pilot project layout  
• To make motion time analysis & line balance bar chart to find out the points to be improved | • Process Layout  
• Motion Time Analysis  
• Line Balance Bar Chart |
| Testing       | • To collect and evaluate requirements for ATE platform development  
• To lead team to select final solutions | • Pugh Matrix  
• Evaluation Matrix |
| End Customer  | • To request delivery in sequence  
• To request PDI (Pre-Delivery Inspection) | • VOC                                      |

Since the pilot project was involved to select final solutions, **PM** became the key person to **introduce the pilot project background**, **collect and clarify the requirements of customer** to team by **meeting** and **VOC**.

**Operation** made **process layout and motion time analysis & line balance bar chart** to find out the points to be improved.

**Testing collected** and **evaluated requirements** for ATE platform development, and **led team to select final solutions** with **Pugh Matrix** and **Evaluation Matrix**.
Let’s go through all final solutions.

**S1, ATE Platform developed by YFVE**
This solution reduced ATE variety on aspects of ATE Supplier, Operator Interface, Hardware Component and Software Language. The changed numbers well addressed the final root causes X1-4 in 2Bc.

More important was the core technical capability we had, which can well address final root causes X2 and X3 in 2Bc.
3Ca. \( \frac{3}{2} \) Describe the solution(s) the team felt would be most appropriate.

Explain how the team validated the final solution(s).

<table>
<thead>
<tr>
<th>Final Solution</th>
<th>Before</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2, Combine motor assembly and ICP</td>
<td>2 ATE</td>
<td>1 ATE</td>
</tr>
<tr>
<td>S3, Two nest</td>
<td>4 ATE</td>
<td>2 ATE</td>
</tr>
<tr>
<td>S4, Small cabinet design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S5, Auto fixture</td>
<td>Manual Scan</td>
<td>Auto Scan</td>
</tr>
<tr>
<td>S6, UUT barcode scan</td>
<td>Visual Inspection</td>
<td>Machine Camera</td>
</tr>
<tr>
<td>S7, Vision test</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pilot Project Layout

Efficiency

S3 Solution Development

S2, Combine motor assembly and ICP
The change in orange circle in the layout helped to smaller cell size.

S3, Two nest
S4, Small cabinet design
The change in red circle in the layout helped to smaller cell size.

S5, Auto fixture
S6, UUT barcode scan
S7, Vision test
The change in green words in the layout reduced 8 labors because of 2 cells for pilot project.

Comparing the improved line balance bar with the initial one, 10% of efficiency was improved, which met the pilot project requirements.
The tangible benefits expected as following:

-$0.89$ million cost saving could be expected from the pilot project ATE investment & labor cost saving bridge with all solutions, so

75.5% cost reduction
10% efficiency improvement from 3Ca
59.8% ATE downtime reduction, considering 85.9% from suppliers in 2Ab, 87% from technique in 2Bc and 80% tolerance.

( 59.8% = 85.9% * 87% * 80%)

43.33% Development Speed Up from ATE development time stacked, comparing ATE development time by supplier with us.
Intangible benefits are more important to stakeholders.

The numbers changed were expected to make job efficient for operator, technician, engineer and management.

With the platform replication to other plants, the results would be maximum on improving engineering skill level, employee morale up and customer satisfaction, which are more important to company goals.
Here as summary, we list the value form the final solutions and we can clearly see how they align with company goal.

The data we used were from 3Ca & 3Cb.
4Aa. **Indicate how** internal and external stakeholders were involved in implementing of the solution(s).

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Type of Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Management</td>
<td>• To approve resource(headcount and training)</td>
</tr>
<tr>
<td>Operation</td>
<td>• To accept and feedback</td>
</tr>
<tr>
<td>Product Designer</td>
<td>• To provide product training and support</td>
</tr>
<tr>
<td>Testing</td>
<td>• To design software &amp; hardware for ATE platform</td>
</tr>
<tr>
<td></td>
<td>• To develop pilot project ATE</td>
</tr>
<tr>
<td></td>
<td>• To install and accept ATE online</td>
</tr>
<tr>
<td>Other Plants</td>
<td>• To support and coordinate for project implementation</td>
</tr>
<tr>
<td>End Customer</td>
<td>• To audit production line</td>
</tr>
<tr>
<td>Supplier</td>
<td>• To technical support during ATE development</td>
</tr>
<tr>
<td></td>
<td>• To provide certain technical training</td>
</tr>
</tbody>
</table>

Please follow me to go through section 4---Implementation & Results.

**Top management** approved the resource we need, including headcount and training.

**Operation** would accept the ATE we developed online as end user.

**Product Designer** provided the training about pilot product to test engineers.

**Testing** designed the software and hardware for ATE platform, developed P32 cluster testers and installed & accepted ATE online.

**Other Plant** managers supported and coordinated the team to implement the project.

**End Customer** would audit our product line before project launch.

**Supplier** gave us software training before test platform development, and technical support during project ATE development.
4Ab. **Describe how** the team identified the various types of resistance. **Describe how** resistance from any of the stakeholder group was addressed.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Type of Resistance</th>
<th>How identified</th>
<th>How Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing</td>
<td>• Tight project timing for ATE development and final solutions implementation</td>
<td>• 3Bb_Pugh Matrix</td>
<td>• Involve experienced engineers</td>
</tr>
<tr>
<td></td>
<td>• Need more headcounts for ATE development</td>
<td>• 1Cb_Negtaive impact</td>
<td>• Persuade top management with headcount study report</td>
</tr>
<tr>
<td>Operation</td>
<td>• High ATE downtime because of new ATE solutions</td>
<td>• 1Cb_Negative impact</td>
<td>• Take it as 6 sigma project to optimize the ATE platform</td>
</tr>
<tr>
<td></td>
<td>• Slow technical support because of long distance</td>
<td>• 1Cb_Negative impact</td>
<td>• Provide full training</td>
</tr>
<tr>
<td>Other Plants</td>
<td></td>
<td></td>
<td>• Spare parts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Onsite support</td>
</tr>
</tbody>
</table>

**S4 Implementation & Results**

**3Bb_Pugh Matrix** and **1Cb_Negative impact** helped to identify the resistance to different stakeholder as following as well as how we addressed:

Tight timing for all solutions implementation for **testing**
We involved experience engineers according to team member skill level evaluation.

Need more headcounts to implement all solution for **testing**
We persuaded top management with headcount study report.

High ATE downtime to **operation** because of new ATE platform and solutions
We took it as 6 sigma project to optimize the ATE platform.

Slow technical support because of long distance to **other plants**
We provided full training, prepare enough spare parts and onsite support.
We list the risk if the project was rejected, like:
High cost and downtime.
No core technical capability.
More Customer complaints.
Lose business.

We reported the benefit and risk to top management and internal stakeholders impacted by this project, so that every stakeholders can understand how important the project to company.
We developed the **milestone for whole project** with right resource.

The **timing plan for each milestone** defined the action step and timing in details.

We set **regular review meeting for timing plan** to monitor the status. The plans above were very important to make sure the project under the control.
Firstly we made the **standardization** of our ATE platform;

**Training and project coaching** were very necessary to make sure all team members understand and follow ATE platform.

Many new issues would appear with more and more project ATE development, it’s a good chance to **optimize** our platform and standard when solving problem with 6 sigma.

It’s a good loop for continuous improvement!
According to quality system, all ATE must be accepted by MSA---Measurement System Analysis.

To make sure the performance of ATE we developed, we installed Minitab to generate MSA report for ATE acceptance.

As basic analysis, resolution, accuracy, stability, Linearity, Precision (Gage R&R) were reported in MSA report. Here showed some MSA reports for pilot project ATE.
How do we make sure the new ATE align with our platform?
We created **ATE development control procedure**.

There're 5 gates.
Gate 1 Engineering and VOC study
Gate 2 & 3 ATE proposal and drawing review with team
Gate 4 ATE acceptance with MSA
Gate 5 Transfer ATE to production

This procedure can help to make sure the ATE we developed to be qualified for long term.
Here we list the actual realized benefits, they were better than expected.

From the increasing quantity of ATE platform replicated to other plants, the total investment saving in 2 years was $4.58 million.

And it would be a long term of saving, more and more!
We had our own core technical capability with 5 patents, which were very important to company!
They were:
Software design
Electrical design
Product knowledge
Protocol application
PC network application
Embedded design
Machine vision technology

The platform was the most important to company goals as mentioned in 3Cb.
Here we can see how the project results contribute to company goals from the value indicated.
Here we can see the result --- ATE platform, we replicated it to other projects, in this way there were great improvements to different stakeholders with the corresponding trend charts as following:

**Top Management**
238% ATE investment reduction

**Mfg Operation**
66% operation efficiency improvement

**Testing**
67% ATE downtime reduction
60% ATE self development improvement
Meanwhile we replicated our platform to other plants, in which way there were great changes to stakeholders listed here as well.

In other Plants, manual test was changed to automation test, product PPM was reduced, and customers accepted the changes, which improved 12.8% of customer satisfaction. Because of it, the business increased rapidly according to the histogram.
Thank you Siva!
Now please follow me go into section 5 --- Team/Project Management

How were the team members selected?

According to the project tasks, we made the project resource and team member skill level evaluation, which would tell us who were the key and right persons for this project.
So here came our team members and how they were involved:

Top management was the sponsor of the project and approve the resource we need.

MBB & BB guided and led the project with 6 sigma concept and tools.

Technical experts and senior test engineers were key persons to create ATE platform and develop pilot project ATE.

The whole testing department was involved for ATE platform replication in YFVE.
Team member is very important to the project.

According to the **project timing** and **team member skill level evaluation**, we **developed a training plan** for whole team.

The training plan covered **6 Sigma GB&BB Training, FMEA, ATE platform** and **Product Oversea Training** in the right time.

The pictures on this slide were 6 sigma BB training from Visteon Statistical Methods Technical Fellow---Jacob (Jake) Frimenko, and platform training to team from our expert.

**Onsite job coaching** can make the team member grow quickly in practice!
As the beginning of team setup, **team ground rule** was defined with team together to make sure everyone follow it.

Since it’s a big project, the **milestone and timing plan** made by team can keep team member clear their tasks in same direction.

**Regular review meeting** with team together can align everyone’s actions in time with **open issue** recorded and followed.

All the information can be shared in **public folder**.

Of course, team daily communication was more efficient to project via **phone**, **email**, **meeting** to clarify and monitor project requirement, status and necessary support…

**Team building** was a good way to inspire team’s passion.
Here are some pictures showing how the team work together!

Technician solder ATE PCB board.
Technician setup ATE hardware.
Test engineer write ATE software source code.
Test engineer and technician debug and accept ATE together.
More and more ATE created by team.
We replicate more ATE to other plants.

All ATE were developed with ATE platform.

Very proud team!
Very proud team work!
Very proud achievement!

Thank you so much for your attention!