

**THE WINSTON CHURCHILL MEMORIAL TRUST OF AUSTRALIA**

**Report by - TOM McELVOGUE - 2007 Churchill Fellow**

**TO STUDY BAND INSTRUMENT REPAIR, CONSTRUCTION AND TOOL  
MANUFACTURE**

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Dated

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## INDEX

Introduction and Acknowledgements	Page 3
Executive Summary	Page 5
Program	
• Yamaha Assembly Plant in Xiaoshan, People’s Republic of China	Page 6
• Yamaha Toyooka Plant in Hamamatsu, Japan	Page 7
• Kanstul Musical Instruments, Los Angeles, California, USA	Page 8
• The 32nd Annual NAPBIRT Conference, Tucson Arizona, USA	Page 9
• Conn-Selmer Inc, Elkhart, Indiana, USA	Page 10
• EK Blessing Factory, Elkhart, Indiana, USA	Page 11
• Getzen Brass Musical Instruments, Elkhorn, Wisconsin	Page 12
• Yamaha Artist Services Inc (YASI), New York City, USA	Page 13
Main Body	Page 14
Conclusions and Recommendations	Page 16

## INTRODUCTION

Between March and May 2008, I had the honour and the privilege to travel to China, Japan and the US to study band instrument repair, construction and tool manufacture as a NSW Churchill Fellow.

My aim was to study current practices and techniques in all areas of this field – from the manufacture process at the major Yamaha assembly plants in China and Japan, and compare and contrast these to the processes involved with a range of mid-size, broader-based and smaller, specialised workshops in the US; to study, review and discuss emerging techniques at the National Association of Professional Band Instrument Repair Technicians (NAPBIRT) annual conference in Tucson Arizona and the review of contemporary tool manufacture, repair techniques and practical one-on-one experience with master repairers in California, Indiana, Wisconsin and New York.

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I gratefully acknowledge the assistance and the support of the many individuals and organisations who have sponsored and supported my project and who have each contributed enormously to the experience and helped make it so productive and worthwhile. These include:

- my Australian mentor, the highly respected veteran Sydney repairer, Mr Brian North of North's Band Instrument Repairs, Wattle Grove, New South Wales, who has taught me so much over the last five years and whose personal recommendations, referrals and contacts opened so many doors for me in every country I visited.

- Yamaha China, for generously allowing me access to their assembly plant in Xiaoshan. I greatly appreciate the time given to me by Ms Li Guihua, Chief Assistant, Manufacturing Department and Mr Toshikazu Ohno, Purchasing and Logistics Manager, for leading me through the tour, explaining each process and answering my many questions. A very special mention also goes to Ms Kate Pollitt and Ms Shirley Zhang at the Shanghai and Hangzhou offices of the Australian Chamber of Commerce (AusCham) for their invaluable support and assistance in arranging this visit.

- Yamaha Japan, for their generosity in allowing me to visit their Toyooka Factory. I particularly appreciated the valuable assistance of Mr Roger Manners, Deputy General Manager, Marketing Division, as well as Mr Takeshi Shigemura, AMI Marketing Department and Mr Marie Kojima, PR and Marketing Section. Additional thanks to Carolyn Gannell at Yamaha Music Australia, who arranged the introductions and helped negotiate and co-ordinate the visit on my behalf.

- Mr Zig Kanstul, Owner, Kanstul Musical Instruments, for opening his Los Angeles factory to me and to Mr Charles Hargett, Sales and Marketing Manager, for the generous time he spent personally showing me around the Kanstul factory and repair workshop in Los Angeles.

- Mr Mark Sorlie, National Warranty Manager, Band and Orchestral Division, Yamaha Corporation of America, for his extensive time and generous sharing of ideas at NAPBIRT

- Mr Patrick S Diller, Parts and Service Co-ordinator, Conn-Selmer Inc., for his extensive time and expertise in demonstrating the latest technologies used by Bach in the manufacture and testing of their products.
- Mr Randy Johnson, President of the EK Blessing Factory in Elkhart, Indiana for kindly allowing my visit and arranging a tour of the EK Blessing Factory on my behalf.
- Mr Brett T Getzen, Special Projects Manager, Getzen Brass Musical Instruments Maker, Elkhorn, Wisconsin, for his generous and invaluable tuition, feedback, sharing of ideas and advice.
- Mr Wayne Tanabe, Senior Technical Manager, Yamaha Artist Services Inc, New York for his enormous time and generosity showing me through the Yamaha Atelier's facility and for demonstrating and explaining the latest technologies that Yamaha are using in instrument repair, as well as for his knowledge and expertise in giving seminars and answering individual questions at the NAPBIRT conference.
- My wonderful wife Caroline and our two beautiful boys, Louis and Frankie, for their support, encouragement and understanding while I was away, and in general, and for all the people who helped make my absence from home possible.
- And finally, of course, my eternal gratitude to the Winston Churchill Memorial Trust of Australia for providing me with the opportunity to undertake this project and for their generous support, encouragement and funding that made this trip possible.

## EXECUTIVE SUMMARY

**Tom McElvogue**, sole-operator and owner of McElvogue Music Instrument Repairs, 9 Frazer Street, Dulwich Hill NSW 2003, Tel: 0416 019 913

**Project Description:** To study band instrument repair, construction and tool manufacture in China, Japan and the United States.

### Project Highlights:

- Personally guided factory tours of both the Yamaha manufacturing plant in Yamaha Assembly Factory in Xiaoshan, China and the Yamaha Toyooka Plant in Japan. Yamaha is a mass supplier of top quality brass and other musical instruments to the world.
- Attendance at the 32<sup>nd</sup> Annual NAPBIRT Conference 'Connecting Great Idea and Great People' in Tucson Arizona to review emerging trends, attend workshops and discuss contemporary ideas with repairers from around the world
- Personal tours of key specialised US manufacturers and workshops, including Kanstul Musical Instruments in LA, the EK Blessing and Bach Factories in Indiana, Getzen Brass Musical Instruments in Wisconsin and the Yamaha Atelier's facility in New York.
- Observation of work practices, discussion and one-on-one time with master technicians Brett T Getzen from Getzen Brass Musical Instruments and Wayne Tanabe, Senior Technical Manager, Yamaha Artist Services Inc, New York

Each of these components of the project was extremely valuable in its own right and the combination of these experiences has given me a comprehensive understanding of the process from manufacture and distribution to the repair and servicing of brass instrument in other countries and many ideas for how these ideas and techniques can be applied in Australia.

As there are currently no courses in this field or large-scale manufacturing plants anywhere in Australia, this project has been a wonderful opportunity to bring this knowledge back home for the advantage of the local education and musical communities.

Since my return to Sydney in May, I have been able to apply and share much of what I have learned with improved tools, better efficiencies and enhanced techniques for the repair of brass instruments that have come to me from schools, professional musicians and music shops.

I have been able to disseminate advice to band conductors, school music department and P&C committees, students and musicians regarding the correct maintenance and care of instruments to prolong the life of the instruments, improve playing performance and minimise the need for preventable and expensive repairs in the future.

## FELLOWSHIP PROGRAMME

### Yamaha assembly plant in Xiaoshan, China

Yamaha is one of the world's largest manufacturers and distributors of musical instruments. Since 2001, Yamaha has assembled its Student Line instruments at the Xiaoshan plant and in 2006, this facility produced 375,000 wind instruments.

Unlike other manufacturers, the Xiaoshan factory operates as a dedicated assembly line production facility. The plant has around 200 staff, some of whom were trained in Japan, and who then returned to China to train other employees.

The work is generally unskilled and highly repetitive, involving the use of many intricate jigs to hold the instrument in place through the manufacturing process. The assembly line process and the use of jigs resulted in improved efficiencies by eliminating the need for staff to align and true the parts to their correct position during handling, and improving work flow and specialisation throughout the process.

The plant operated with separate stations for each stage of the manufacturing process and each instrument followed the same steps, in consequence:

- initial assembly, preliminary inspection, including slide testing, air testing and removal of any excess solder from any of the parts.
- the parts would be attached using a lead-free solder and the instruments were then bathed in ten to twelve different tubs of cleaning solutions. They were then buffed to give them a highly lustred finish
- further inspection and testing before being cleaned in a range of solutions and lacquered
- the instruments were reamed for specific diameters, re-cleaned then underwent another inspection for slide and valves manoeuvrability and adjusted
- they were then play-tested and sent on to a final inspection station, before being placed in individual cases and boxed for distribution

I was shown through each of these stations and was permitted to ask questions of all workers, as well as my guides, freely. Despite the repetitive nature of the work, staff seemed happy, friendly and diligent, and kindly accommodated my many questions.

This was my first experience of being able to observe a major manufacturing plant in full operation and I am extremely grateful to Yamaha Xiaoshan and all the staff I encountered for granting access to their facility and for being so helpful throughout my visit.

## **Yamaha Toyooka Plant in Hamamatsu, Japan**

In contrast to China's assembly-line procedures, Japan's Toyooka plant was a complete production plant from sheet metal to instrument.

I was met at Hamamatsu Station by Mr Takeshi Shigemura, the Asia-Pacific Marketing and Sales Manager in Yamaha's AMI Marketing Department. Over lunch, he explained Yamaha's history from the original company Nikkan to one of the world's most recognised brands today.

Yamaha's Toyooka plant is a highly automated assembly and manufacturing plant, enabling them to produce a wide range of instruments at a high volume.

I was also introduced to Mr Roger Manners, a trumpet player and now the Deputy General Manager of Marketing. He guided me through the factory and provided me with many valuable and interesting insights into the production of Yamaha's brass instruments.

We started at the hand-hammering bell section and the student line machine spinning bell and bell end sections of the factory, then proceeded to the assembly lines. As in China, these used similar jigs to speed up the assembly and avoid sighting and alignment issues.

We then moved on to the soldering stations for parts. The stations were a mix of manual and automated areas. Roger then showed me the stamping process, whereby the Yamaha logo is inscribed on the instruments and viewed the valve cluster assembly procedure.

I was then given an opportunity to observe the CNC lathes, which are used in the production of the valves and mouthpieces. We then viewed the automated plating process of the valves and the polishing and buffing procedures.

Roger then guided me through the electronic lacquering process, which involves the lacquer being drawn on to the instruments by the use of positive and negative electrical charges. I was also able to observe the formation of the saxophone bells via water pressure and the fully-automated flute tone hole conveyor belt process, which was truly amazing to see.

Roger also showed me through the temperature-controlled oboe and bassoon assembly sections. These are strictly temperature-controlled to preserve the integrity of the materials used.

Following the tours, we had a Question and Answer session where we discussed a range of Research and Development questions. This included detailed questions, explanations and discussion of mouthpiece sizes, shapes, altering cup sizes and shapes, the placement of braces, losses of vibration, and measurements of specifications of different instruments.

Roger was incredibly generous with his time and expertise and went out of his way to ensure that I left with a thorough understanding of the processes and innovative technologies in place at the Toyooka production plant.

I am extremely grateful to Yamaha Toyooka for allowing access to their operation, for their generous hospitality and for the time, courtesy and patience shown to me throughout my visit.

## **Kanstul Musical Instruments, Los Angeles**

Mr Zig Kanstul has been responsible for designing and manufacturing brass and wind instruments bearing some of the most respected names in music, as well as pioneering innovative techniques to improve the quality and musicality of instruments bearing his name. He is a master musical instrument craftsman and has worked with the likes of Eldon Bonge and FE Olds.

My time at his factory was a truly incredible experience. The amount of tools, jigs and moulds for parts is staggering.

Charles Haggert, trumpet player and Sales and Marketing Manager for Kanstul, took me for a tour of the factory and was incredibly generous with his time and knowledge.

Kanstul's production process is a much more hands-on process compared to the large scale, mass-manufacturing plants in China and Japan. The workers are personally trained by Zig himself, are each highly-skilled and appear to be totally passionate about what they do.

The tour began at the parts section, then Charles and I moved on to the assembly and soldering section where a specialist worker demonstrated spinning a professional line trombone bell.

We then moved on to valve construction, bell formation and large tube bending, lacquering, buffing, mouthpiece making and from there, to the final assembly benches, including the slide fitting benches, final polishing process and the casing and boxing areas.

I then viewed an incredible mouthpiece copying machine, which involved a probe that can read all the external and internal dimensions of any mouthpiece and reproduce it. The technology used is an adaptation of the probe technology used by NASA and is at the absolute forefront of brass instrument manufacturing industry.

Again, I am indebted to Zig Kanstul for allowing me access to his factory, to Charles Haggert for his generous time and explanations, and to the many craftsmen I met for their inspiration, expertise and ideas that they were so willing to share with me.

## **The 32<sup>nd</sup> Annual NAPBIRT Conference, Tucson Arizona**

From April 11 to 14, I attended the 32<sup>nd</sup> Annual NAPBIRT Conference 'Connecting Great Idea and Great People' in Tucson Arizona.

Each year, NAPBIRT tries to bring something new to the annual conference and in 2008 they organised a State of the Industry Forum comprising of industry leaders representing manufacturing, supply and retail in an open discussion format. Delegates were given an opportunity to ask the panel questions across a broad range of industry issues in a live, open forum.

I also attended tutorials and workshop clinics in retrofitting rotary valves, clarinet tenon repair, the use of sherline lathes, clarinet overhauls, key fitting, cracked bells, padding, stuck slides, burnishing, trombone slide overhauls, tuba bow dent repairs, patch making and valve repair.

The conference also provided many informal opportunities to meet and share ideas with fellow repairers, tool manufacturers and the leaders in the instrument repair field. Particular highlights of the conference include meeting:

- Mr Wayne Tanabe, Senior Technical Manager, Yamaha Artist Services Inc, New York. Wayne is not only incredibly knowledgeable and a true master craftsman, he is extremely generous in sharing his knowledge, as I was to find later when I attended his workshop in New York. We discussed at length the latest innovations Yamaha is using in their brass instruments and he recommended some terrific resources for specialised acoustics and mouthpiece design.

- Mr Patrick S Diller, Parts and Service Co-ordinator, Conn-Selmer Inc., (a subsidiary of Steinway Musical Instruments). Pat was very friendly and informative regarding the processes used in the production of Bach instruments at the Bach plant in Elkhart, Indiana.

- Mr Mark Sorlie, National Warranty Manager, Band and Orchestral Division, Yamaha Corporation of America. As with Wayne and Pat, Mark was very generous with his time and sharing of ideas, advice and expertise.

Each of these people shared knowledge and skill in instrument making or repairing, a passion for music, and a desire for a high standard of excellence.

To be in conference with the leaders in all areas of brass instrument manufacture and repair for five days, and to be given the opportunity to review emerging trends, attend workshops and discuss contemporary ideas, tools and technologies with repairers from around the world was an amazing experience and gave me a fantastic overview of current industry trends as well as 'over the horizon' technologies and innovations at the forefront of this industry.

By learning about the new products entering the market, observing first-hand the innovations demonstrated by a range of tool manufacturers servicing the industry, and discuss techniques and issues with a wide range of industry experts and fellow repairers, I was able to compare and explore a range of approaches to particular situations. This will inform my own approaches and future directions taken to repair in my own practice back in Australia, which will lead to reduce costs and a better standard of repair.

## **Conn-Selmer Inc, Elkhart, Indiana**

Conn-Selmer, Inc. is a leading manufacturer and distributor of band and orchestral instruments for professional, amateur and student use in the US.

The company manufactures and distributes its products under a variety of well-known brand names, including Vincent Bach brass, Selmer USA woodwinds, CG Conn brass, King brass, Armstrong woodwinds, Ludwig and Musser percussion and Glaesel string instruments. Other brands include Scherl & Roth and William Lewis & Son string instruments, Emerson flutes, and Benge brass. Under its Leblanc division, the company also manufactures and distributes Leblanc, Holton, Noblet and Vito band instruments.

The company has ten manufacturing and distribution operations in Ohio, North Carolina, Illinois, Indiana and Wisconsin, as well as a factory in France. As well as manufacturing its own instruments, Conn-Selmer is also a major importer of musical instruments from around the world for distribution in the US market.

Conn-Selmer maintains the highest quality of manufacture using proven designs and also dedicates considerable resources to research and development in order to continuously improve musical performance in new instruments.

I caught up with Pat Diller, who, as well as being so generous with his time with me at NAPBIRT, spent a whole day taking me through the processes of instrument manufacture at the Conn-Selmer plant in Elkhart.

The plant is extensive in size and has an enormous area dedicated to parts storage. Pat also took me through the state-of-the-art sound booth where Conn-Selmer technicians rigorously test their instruments to ensure the highest quality control and performance. The audio equipment in the studio can replicate any playing situation, from small practice rooms to stadium-sized arenas.

The tour gave me an enormous appreciation of the hands-on approach taken by Conn-Selmer in their approach to instrument manufacture and the ongoing dedication and resources spent to ensure the highest level of performance and musicianship.

I am particularly grateful to Pat for his detailed and interesting explanations to all my questions and his passion for excellence on both a personal and company level.

## **EK Blessing Factory in Elkhart, Indiana**

EK Blessing is a family owned business that has been in operation for over 100 years. Established in 1907 by Emil Karl Blessing, the company today is run by his great grandson, Mr Randy Johnson.

The company is based in Elkhart, Indiana, and they employ some of the most talented craftspeople and artisans in the business, many of whom have been making and designing instruments most of their lives. The factory is a hybrid of the latest technology and traditional tools and methods that have been finely tuned over decades.

The company philosophy is to incorporate advanced levels of performance and manufacturing with every instrument they produce. In January 2008 the company launched the all-new Blessing brand.

I was met by Mr Randy Johnson, President of the EK Blessing Factory, who generously arranged a tour of the premises and allowed me to view operations throughout the assembly process.

EK Blessing is deeply committed to bringing the best possible musical instruments to the marketplace, as well as developing new and improved products, which is considered a never-ending process. Design enhancements are the result of customer feedback, market analysis and internal scrutiny from the artisans within the company.

Unlike the larger mass-production and assembly-line operations I had visited previously, EK Blessing instruments are totally handcrafted.

I was initially taken to the final assembly section and the play testing room where the finished products undergo rigorous Quality Control testing before being released for sale. I was then taken through the lacquering booth, which again, unlike the mass-manufacturers, is a totally manual process.

This was followed by a tour through the bell spinning section where the bells are coated with a wax substance during the spinning process. This is unique to EK Blessing horns and, along with the lacquering process, enhances the durability and quality of the instrument.

I left the factory with an increased understanding and appreciation of the artistry involved in creating each and every EK Blessing instrument and I am extremely grateful to Randy Johnson and his team for the opportunity to view these processes first-hand, which was a real highlight of my trip.

## **Getzen Brass Musical Instruments, Elkhorn, Wisconsin**

Getzen Brass Musical Instruments is a family company, established in 1939 by Mr TJ Getzen. The company hit production and financial troubles in 1960 and was sold, but retained the Getzen name. In 1991, the family bought back the company and it has remained under the family's ownership and control ever since.

The company is presently managed by Mr Tom Getzen, while Tom's son, Mr Brett T Getzen, operates as the Special Projects Manager.

Re-establishing the company's place in the industry has been a key priority for Tom Getzen and since regaining control the family has reviewed and re-evaluated the entire Getzen line. All models were individually assessed and some lines were discontinued, while others models were improved and updated to improve instrument quality.

This stringent and open approach has led to the Getzen brand regaining its premier reputation as a leader in quality and craftsmanship in today's market.

I had the privilege of spending an entire day with Brett Getzen at the Elkhorn facility. Brett took me through the entire Getzen factory and gave the opportunity to observe the complete production process of their instruments from start to finish.

Getzen uses a number of extremely innovative approaches to assess and improve valve production. One example that Brett showed me is the use of continuous valve action machinery to recreate stress levels and wear and tear damage that would be encountered over the lifespan of a range of instruments with prolonged, heavy usage. The information generated is then compared across instruments and used by Getzen to formulate techniques and treatments designed to prolong the life and performance of their valves and associated parts.

This, and other innovations in Research and Development has led to improved performance and durability of the valves and other components that Getzen manufacture for their trumpets and re-established their reputation as an industry leader in brass instrument manufacture valve production.

While most other contemporary manufacturers now tend to use monel for their valves, Getzen prefers nickel-plated pistons. This is an interesting point of difference between Getzen and other manufacturers and Brett and I discussed this issue at length during my visit.

I am extremely grateful to the Getzen Brass Musical Instruments family for allowing me access to their facility and in particular, to Brett for his openness, generous and invaluable insights, and for all his ideas and advice.

## **Yamaha Artist Services Inc (YASI), New York**

My final visit was to the state of the art Yamaha Artist Services (YASI) facility in New York City. YASI is dedicated to meeting the needs of artists, artists' managers, performing arts organizations and educational institutions worldwide. Since its establishment in New York in April 1987, it has gained widespread recognition for its high standards of professional service and devotion to the global performing arts community.

The Band and Orchestral Atelier, features a beautiful showroom, fully stocked with professional instruments, often including the latest Yamaha prototypes and one of the most well-equipped custom instrument shops in the US.

The artists who come to YASI come from top-line performance organisations throughout the US and the world. The Atelier's Showroom has the excellent natural acoustic attributes required by professional musicians when evaluating instruments, as well as the latest audio-video equipment to view and hear their latest recordings.

Operated by top staff including world-class technicians, the Atelier's custom shop offers comprehensive repair resources, unique instrument customisations and one-of-a-kind instrument design capabilities for virtuoso orchestral musicians, soloists and jazz artists.

The technician staff also use this resource to make important contributions to Yamaha's global R&D efforts and YASI is called upon regularly to participate in ongoing development projects.

On my visit, I had the honour and the privilege of spending a full day as a 'fly on the wall' with Yamaha Atelier, Mr Wayne Tanabe. Wayne took me through the entire Atelier facility and demonstrated an array of the latest innovations in cleaning technology for brass instruments.

He has a comprehensive range of the most advanced tools at his disposal including soldering equipment, bell forming mandrels and mouthpiece copying equipment. I was allowed to observe him as he worked through a number of processes and these tools were demonstrated to me at different stages of my visit.

Wayne also demonstrated a range of innovative methods of testing and assessing sound qualities for the instruments requiring his attention. These included a machine to measure frequencies when people play high & low in order to gauge whether the processes used were enhancing the sound or detracting from it.

This day was an amazing experience for me and I am extremely grateful to YASI for this wonderful opportunity. I am also enormously grateful to Wayne for his extreme generosity, expertise and kindness as he showed me through the Atelier's facility and took me through each of the processes that he was working on, as well as for his knowledge and expertise in giving seminars and answering individual questions at the NAPBIRT conference.

## MAIN BODY

My Fellowship was to travel to China, Japan and the US to study band instrument repair, construction and tool manufacture and to gain practical understanding and insights into how Best Practice can be applied to the repair and maintenance of instruments in Australia.

My aim was to study current practices and techniques in all areas of this field and was broadly divided into three main areas:

- observation of the manufacture process at the major assembly plants in China and Japan, and comparing and contrasting these to the processes involved with a range of mid-size, broader-based and smaller, specialised handcrafted workshops in the US.

- attendance at the National Association of Professional Band Instrument Repair Technicians (NAPBIRT) annual conference in Tucson Arizona, where I was able to participate in clinics, tutorials and forums that gave me a unique opportunity to review and discuss emerging techniques and technologies, and establish contact with fellow repairers and master technicians.

- additional opportunities to review contemporary tool manufacture, repair techniques and gain practical one-on-one experience and the exchange of ideas with master repairers in California, Wisconsin, Indiana, Illinois and New York.

I observed and learned about the latest developments in instrument manufacture and was able to compare the highly automated mass-manufacture assembly line production factories in China and Japan with medium and smaller specialised facilities in the US that used a mix of automated and traditional handcrafting techniques, as well as a facility that exclusively handcrafts its instruments, using both traditional and modern methodologies and techniques.

The range of manufacturing techniques across the spectrum enables manufacturers to service and appeal to different markets, and adapt to these markets as they develop.

Obviously, the implementation of automated techniques and assembly-line production by the major instrument manufacturers such as Yamaha has led to economies of scale, improved efficiencies and cheaper and more widely available instruments for the mass markets around the world. Combined with the existing trade links and proximity to Australia, this has resulted in the proliferation of these instruments in the Australian market.

The lower prices that have resulted as a consequence of mass-production have made these instruments much more affordable and available for beginners to take up the study of brass instruments, ensuring a healthy and constantly renewing market that could be jeopardised if brass instruments were priced out of reach of the beginners' market.

(It should be noted at this point that the student and professional mass-manufactured instruments produced in the Yamaha factories in China and Japan are all high quality instruments, and assembled from the same high quality parts created in the Toyooka plant. These instruments are not to be confused with the recent influx of cheap and poorly-constructed brands from the region into Australia, which are also being aimed at the student market. As a general rule, I would never recommend these instruments for purchase, even at the student level, as the sound quality is

completely inferior and instrument construction of such a poor standard that no amount of technical treatment or repair will assist in any noticeable improvement in sound or durability).

At the more elite level, having a range of specialised models produced under mass manufacture enables many professional musicians to be able to afford to own and experiment with a range of models for different sounds and nuances.

By visiting the factories and being able to talk directly to the manufacturers and to understand the processes involved, I will be able to give detailed and informed explanations to band conductors, P&C and band committees, shops and musicians, provide better information regarding the comparison between these and other instruments, and to give a more informed opinion as the cost-benefit analysis of the mass-produced instruments compared to the more expensive, handcrafted instruments imported from the US and Europe.

It was a privilege to also observe and spend quality time at the smaller, specialised manufacturers I visited in the US. Due to the higher level of specialisation and sophisticated, labour-intensive workmanship involved, these instruments are obviously more targeted to the elite end of the market.

By observing and understanding the manufacture of these instruments, I can suggest more specialised maintenance techniques and treatment in their repair and daily upkeep to musicians to preserve the integrity and quality of their instruments.

In addition, by establishing personal contact with these manufacturers and technicians at the factories, I am also better placed to make enquiries and research solutions for any 'one-off' problems that I may encounter in my repair business that involves their instruments

The tools and emerging technologies I was able to study and review at NAPBIRT and the various workshops and factories in the US have been invaluable in my repair business back in Sydney. Seeing these tools and processes in operation and having the opportunity to discuss and ask questions directly to master technicians and tool manufacturers in the NAPBIRT clinics and tutorials has enabled me to select the best possible tools and techniques for my practice.

This has had a two-fold impact on my practice – i) the quality of my repair work has been enhanced and ii) the resulting improvements in efficiencies and reduced labour costs have been passed on to my clients through reduced charges.

Spending time with world-class technicians such as Ed Strege, Pat Diller, Brett Getzen and Wayne Tanabe has been nothing short of a total privilege and honour. Their passion for excellence, commitment to the industry and generosity of spirit was overwhelming and I will be forever grateful for the knowledge, tips and general that they have imparted to me.

## CONCLUSIONS

Each component of my project was extremely valuable in its own right and the combination of these experiences has given me a comprehensive understanding of the process from manufacture and distribution to the repair and servicing of brass instrument in other countries and many ideas for how these ideas and techniques can be applied in Australia.

As there are currently no courses in this field or large-scale manufacturing plants anywhere in Australia, this project has been a wonderful opportunity to bring this knowledge back home for the advantage of the local education and musical communities.

Since my return to Sydney in May, I have been able to apply and share much of what I have learned with improved tools, better efficiencies and enhanced techniques for the repair of brass instruments that have come to me from schools, professional musicians and music shops.

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## RECOMMENDATIONS

I will continue to disseminate advice to band conductors, school music department and P&C committees, students and musicians regarding the correct maintenance and care of instruments to prolong the life of the instruments, improve playing performance and minimise the need for preventable and expensive repairs in the future.

I can do this in my existing role as repairer, through my work with schools around the Sydney region and with musicians as a trumpet player with bands.

In addition, I am in the process of setting up a professional website to complement my repair business and which will include a comprehensive and easy to follow Q and A section and general tips for instrument maintenance.

I remain an active member of NAPBIRT and will continue to research and monitor issues raised by fellow members and to implement these findings and advances in my repair work.