



倾听 ZPMC 的声音

2018年 第2期

总第30期

主管、主办：上海振华重工（集团）股份有限公司

振华重工

SHANGHAI ZHENHUA HEAVY INDUSTRIES CO., LTD.

人工智能助推 全球港口走向无人模式

【封面故事】人工智能助推全球港口走向无人模式

【高端访谈】智能化港口时代的振华“转型”

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2018 年第2期

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Brand image of ZPMC

Issue 2 2018

Volume 30

Listen to the Voice of ZPMC

Published by ZPMC



ZPMC

SHANGHAI ZHENHUA HEAVY INDUSTRIES CO., LTD.

智慧港口： 港口的未来方向

文 / 李雪娇

港口是区域经济发展的重要基础设施，更是沿海沿江各省实现经济发展战略的重要支撑。近年来，信息技术、智能技术应用呈爆发式增长，已成为交通领域最活跃最积极的影响因素。智慧物流发展要求港口物流新升级，智慧港口建设成为港口发展新趋势。

什么是“智慧港口”？“智慧港口”是以现代化基础设施设备为基础，以云计算、大数据、物联网、移动互联网、智能控制等新一代信息技术与港口运输业务深度融合为核心，以港口运输组织服务创新为动力，以完善的体制机制、法律法规、标准规范、发展政策为保障，能够在更高层次上实现港口资源优化配置，在更高境界上满足多层次、敏捷化、高品质港口运输服务要求的，具有生产智能、管理智慧、服务柔性、保障有力等鲜明特征的现代港口运输新业态。

毫无疑问，智慧港口代表着未来港口的发展方向，孕育着新的机会和可能性。当前，科技发展已经为“智慧港口”的建设奠定了基础。在新的转变中，港口的战略焦点将从控制资源转为精心管理资源，从优化内部流程转向更多地与外部互动，从增加客户价值转为将生态系统价值最大化。

智慧港口建设是个复杂的过程，需要多方参与。作为港口机械行业的领先者，振华重工正不断发挥品牌优势、创新优势和平台集成优势，汇集相关方的智慧和力量，为推进全球智慧码头的建设提供振华方案。

未来，智慧港口将朝着更高效、更安全、更绿色、全面智能化的方向发展。万物互联降低了自动化码头的建设成本，智慧港口建设已经在路上。



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2018年11月, 12月
2018年第2期 总第30期

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上海振华重工（集团）股份有限公司

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(K)第0680号

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印刷：上海中华印刷有限公司



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人工智能助推全球港口走向无人模式

振华重工打造自动化码头一站式解决方案

文 / 振华重工副总裁、智慧集团董事长 张健

2018年，物联网、人工智能、边缘计算、区块链、5G通讯等技术迅猛发展，引领新一轮产业变革。变革与创新席卷港口码头，从机械时代转向人工智能时代已经成为港口业共识。振华重工在推进码头智能化建设中持续思考和探索，并推出了针对自动化码头业务的一站式解决方案。

打造自动化码头一站式解决方案

从项目前期的规划仿真，到执行中的设备制造、系统总集成，再到投入生产后的运营维护，振华重工推出的自动化码头一站式解决方案，在一个个项目实践中落地，获得了市场的认可。

2018年，振华重工推出的商业生态平台 Terminexus 正式投入运营，已陆续与上港集团、马

士基、和黄、招商港口等签订了码头装备的备件供应 VMI 合同及二手设备交易合同。

2017年12月20日，振华重工与印度阿达尼（Adani）集团签订自动化码头系统总承包项目。该项目是印度首个自动化码头，也是振华重工与阿达尼（Adani）集团合作以来的最大合同。在该项目中，



变革与创新席卷港口码头，从机械时代转向人工智能时代已经成为港口业共识。

振华重工除了提供常规的自动化港机设备、设备管理系统（ECS）以外，还将提供码头管理系统（TOS）、码头闸口系统（GOS）以及冷藏箱区管理系统（RMS）等相关子系统的集成，还包括了码头运营所需的备件供应服务。该项目的落地标志着振华重工的自动化码头一站式解决方案获得市场认可，是振华重工在自动化码头领域具有里程碑意义的项目。

青岛自动化码头一期自2017年5月11日开港以来，运行效率连破纪录。青岛自动化码头一期的巨大成功，让青岛港体验到自动化码头的效率和效益。2018年9月8日，青岛港集团再次与振华重工签约，

启动青岛港全自动化码头装卸系统总承包项目二期工程建设，目前项目进展顺利。

2017年12月10日，全球单体最大的上海洋山四期自动化码头正式开港运营，2018年突破200万标准箱，2019年计划完成300万标准箱，后期将继续扩大规模，最终有26台岸桥、约120台轨道吊和超过130辆自动化引导小车（AGV）投入使用，吞吐量将达到630万标箱每年。

2018年2月12日，振华重工中标天津五洲国际码头堆场自动化改造项目，标志着公司在自动化堆场改造领域又迈出关键一步，这也是国内首个大规模的

堆场自动化改造项目。同时，振华重工将与天津港信息公司合作，对自动化堆场的调度模块进行优化。

此外，振华重工为上海振东集装箱码头的传统轨道吊堆场进行自动化改造，并于2016年11月正式投产，最高作业效率是原来的两倍。去年底，振东码头又启动了二期建设，目前正在规划三期工程。

此外，还有一大批自动化码头正准备筹建，振华重工正在为他们量身定制解决方案。在与客户不断磨合与沟通的过程中，振华重工最终形成了在自动化码头解决方案上的特色。

港口智能化发展的展望与思考

自动化、智能化码头的发展与技术发展紧密相连，传感技术、移动设备、视频分析、无线射频技术、无人机、3D打印、5G通讯、云计算、人工智能、网络传输、网络安全、新能源等技术的突破将促进新技术在码头不同环节的应用。作为设备制造商和系统供应商，振华重工与合作伙伴一起研究、设计、测试，努力将新技术应用到设备及系统的更新升级中，努力降低设备及系统的造价成本、提高系统的智能程度和设备的安全等级。



为了降低磁钉对码头基建的要求，公司正在测试不同的车辆无线定位技术。为了实现更安全的轮胎吊大车防撞，公司正在测试视频、激光、超声波等不同组合的大车防撞方案。为了便于用户对钢结构的巡检，公司与合作伙伴一起开发了无人机钢结构巡检系统。为了提高通讯速率和稳定性，降低通讯系统费用，公司正在测试和验证无源光网络系统在自动化码头系统中的应用。为了解放自动化码头中的唯一人工，公司正在努力研发自动拆锁机，并已取得一定进展。

随着港口水平运输环节人力成本、燃料成本持续增加，运输安全与效率问题成为港口用户的关注点。振华重工与国内知名人工智能公司合作，联合开发无人驾驶跨运车实现自动行驶、精确停车、集装箱装卸、障碍物避让、超车换道和多车协同作业等功能，有力推动港口水平运输装备的智能化转型。

针对日益繁忙的汽车滚装码头业务，振华重工也研发推出了以智能整车库为核心的汽车智能仓储方案。与传统的堆场或自走式停车楼相比，智能整车库采用仓库式保管，能最大限度的保护新车，避免风、雨、沙、灰、盐雾等对车辆的侵蚀。同时，单个车位占地面积从通常的17-24平米/车位降低到2.2

平米/车位，且能实现对库存和货位的实时信息化管理，减少工作人员数量及人为差错，保证货物管理及装运计划的准确性和实时性。另外，以自动化存储方式代替人工停放，大大降低劳动强度，提高运行效率。振华重工已具备智能整车库的各项技术，并且已为国内外多家汽车滚装码头提供了成熟方案。

当前，港口竞争已不仅是深水港、大泊位、大堆场、集疏运体系等基础硬件之争，更是港口供应链和物流服务等软实力之争。软实力的建设需借



当前，港口竞争已不仅是深水港、大泊位、大堆场、集疏运体系等基础硬件之争，更是港口供应链和物流服务等软实力之争。

助物联网、大数据、云计算、人工智能等高新科技手段来优化港口集转运系统，改善装卸工艺，提高装卸作业效率，进而缩短船舶在港靠泊时间，降低班轮公司运营成本。如此，通过软硬件的完美结合，优化提升港口的基础设施和管理模式，实现港口的功能创新、技术创新和服务创新，使其真正具备“智慧”能力。这已经成为各港口提高自身竞争力、抓住发展机遇的重要途径，也是提升港口国际竞争力的重要途径。

随着对智能化码头研究的深入，我们发现目前所做的仅仅是拉开智能化码头建设的帷幕。设备层需要

更加高效、环保；信息层需要更大范围的互联、互通；计划层需要更智能的预判、预测；整个系统需要更协调、高效。在每个层面都有大量的工作需要开展，这也是我们倡导建设一个开放包容的智慧港口生态圈的原因。

展望未来，港口的适应性变化也为振华重工与合作伙伴提供了广阔舞台。大家应优势互补，集群发展，培育码头智能化发展新动能，让港航产业变革为各国人民带来更多福祉！

（供图 / 季学卿 梅涵 李学民）

精心“呵护”： 构筑设备全生命周期服务体系

文 / 张永秀

“买完设备，过了2年维保期出现故障怎么办？”“设备使用出现故障，等工程师到现场太影响工期。”“找专门的维保公司，费钱又误时。”“你们就不能延长一下设备的维保期？毕竟我们培养自己的维修团队成本太高……”在振华重工做售后服务的那几年时间里，曹永平常常收到这类“吐槽”邮件，“无限期地延长维保显然不现实，但还是要向客户解释。”曹永平苦笑道。

如何才能让用户使用设备不再有后顾之忧？为此，振华重工在全球范围内开展市场调研，聚焦客户集中关注的维保问题，并推出ZPMC Care+服务平台，为码头设备提供全生命周期的维保服务。

一台设备从开始工作那一刻起，ZPMC Care+开始了对它全生命周期的“呵护”。比如，在港机设备的例行检查中，无人机巡检系统的诞生颠覆性地取代了人工攀爬的传统巡检方式。在最新的检测实践中，无人机2小时巡检40个高空区、提高了8倍的巡检速度、且实现了360度无死角检测。无人机巡检系统解放了人力，也消除了检测盲区，维保人员再也不用像钢铁侠一样在高空攀爬，巡检之后，也无需人工录入检测数据，“前端APP自动规划航线线路，一键上传巡检数据；系统后台程序进行图像诊断，同步生成评估报告，为客户带来极速的评估体验。”维保服务平台项目的研发人员李文军介绍道。

全生命周期的维保不仅包括例行检查，防患于未然同样很重要。为了将隐患“扼杀在摇篮里”，振华重工在设备监测上大做“文章”。振华重工智慧集团



工程师韦燧介绍说：“起重机智能检测系统可以实时监测码头的整体运作情况，支持多数据接口、能进行历史回放，帮助客户更好的了解设备状况。”此外，研发团队在监测基础上增加了专家分析，动态显示多个重点检测点，实现设备的健康诊断。在大数据技术的支撑下，振华重工成功与洋山四期自动化码头合作，开展设备预测性的维护服务。“我们搜集了设备的过往使用数据，进行积累和分析，预测设备可能出现的问题，并提前处理，帮助用户降低设备使用的风险。”振华重工智慧集团技术总监杨仁民说道，“比如在岸桥上，我们重点监测主要承重部位，这里的钢结构更容易发生裂纹，提前介入能够降低使用风险，延长设备寿命。”

“振华的港机产品在全球市场占有率很高，我们愿意承担更多责任，将设备维护服务做得更完善，构筑全生命周期服务体系，帮助客户降低码头运营成本，提高作业效率。”曹永平说。

(供图 / 李学民)

隐形“交警”上岗

文 / 慕立琼

繁忙的码头上，一群智能搬运工——集卡、自动引导运输车（AGV）、无人跨运车在岸桥和堆场之间穿梭不停，忙碌而又井然有序。突然，一辆集卡在路中间停了下来。后方作业的小车眼看就要撞上“罢工”的集卡时，突然小车减慢车速，变道驶入左侧的慢速车道，整个过程行云流水、一气呵成。

撞车事故有惊无险，多亏了背后的隐形“交警”——振华重工自主研发的智能化车队管理系统，引导码头上各类水平设备平稳、高效地运行。随着技术的不断进步，水平运输设备智能化水平越来越高，甚至可与人工调度相媲美，但由于系统指挥角色的缺位，可能会出现车辆死锁造成的拥堵情况。“简单来说，就是现有运输表现不那么聪明。”智能化车队管理系统研发负责人王小进介绍说。

如何让码头的水平运输变得聪明智能？王小进发现，如果背后有个聪明的“大脑”统一决策，那么拥堵问题可以迎刃而解。振华重工开始探索研发智能化车队管理系统，该系统更加适用于水平运输设备较为集中的场所，比如码头、物流园区、空港等，采用强“大脑”和强单体的并存模式。“大脑”是总指挥者，负责综合作业的统筹规划；强单体是智能运输设备，具备一定的自我决策能力。“大脑”的计算能力和强

单体的作业精度完美结合，甚至超过调度员和司机之间的默契度，提高了码头的运营效率。

“智能调度是这个系统的最大特点。”王小进介绍说。当一辆集卡转弯进入高速车道时，可能出现多辆车选择同一车道，部分路段因而变得拥挤。该系统上马后，车辆可根据实时路况快速分散，既不会绕远路，又不会形成局部拥堵，很好地解决了码头水平运输中存在的交通堵塞问题。

应用智能化车队管理系统，还能延长设备的使用寿命。“每个设备投产后必然会出现老化现象，原本一辆车在某个范围内行驶是安全的，车辆老化后就需要更大的范围来确保行驶安全，这时候系统会根据车辆的使用情况自动调节，也就是所谓的高自适应性。”项目工程师陈波介绍道。当车辆作业时，突遇前方路段不畅通，可通过系统反馈的预计阻碍时间，判断当前是否需要减速，减少了频繁加减速带来的车辆能耗，同时也减少了任务衔接中不必要的等待时间，延长设备的使用寿命。

码头运营时忙时闲，相应地，这套智能化车队管理系统也有两种应对模式。闲时系统采用节能模式，减少空驶率，降低能耗；忙时高效模式上线，效率更高。系统聪明之处在于第三种平衡模式，“大脑”会根据现场情况做出最优判断，为了应对恶劣天气等不安全环境，系统还配备了特殊的安全模式。

未来，智能车队管理系统还会在跨项目、跨领域中应用，比如从码头应用到仓储。“简单来说就是实现不同策略的最优化，从而更加适应其他项目。”王小进总结道。



让港口成为世界的绿色窗口

振华重工推出港口智慧能源解决方案

文 / 徐小勇

港口能源发展的现状和最大的困扰是什么？振华重工对全球港口能源进行了初步调查，总结出三个主要问题。首先是能耗高，污染严重。在一些港口城市，港口污染物排放量已经占到当地空气污染物总量的一半以上。其次是电源升级需求。随着业务量的持续扩大，不少港口新增用电设备，与此同时，随着油改电、增加岸电电源等工作不断推进，港口电源升级改造需求日益迫切。最后是电价高造成港口运营成本高。一些港口电价达到每度电 20 美分，导致已经安装的绿色能源装置使用率极低。

为了解决上述难题，振华重工推出了港口智慧能源解决方案。这是一个由点到面，涉及发电、用电、能源管理的综合性方案，主要由五部分构成。

一是新能源方案。包括光伏、风电等不同类型的可再生能源，主要利用港区屋顶、空地等闲置面积建设分布式光伏、风电、天然气站等新能源发电站，供应清洁、低价的能源。即使码头比较小，闲置空地少，

振华重工也会结合码头实际量身定制方案。光伏不仅可以安装在地面、山坡、屋顶、水面，甚至还能作为幕墙、车棚顶、隔音板进行安装，最大程度的利用港区面积。采用该方案，港口可以享受低价、清洁的能源供应。

二是储能方案。这是以电池储能为主，融合其他新兴储能方式及电池梯次利用的多元化解决方案。梯次利用是指将退役的锂电池等储能元件进行筛选，二次利用于储能系统。通过梯次利用，延长锂电池的使用寿命，降低码头的投资成本。储能方案可以利用港区的峰谷电进行调峰，储存低电价的电，在高电价时放电出来使用，从而降低码头运营能耗成本。同时，储能方案还可以对变压器的需量进行管理，通过计算码头用电峰值，为高峰用电提供补充电能，进一步降低港口的电费成本，提高用电稳定性。

三是电能替代方案。该方案包括新能源车及充电桩系统，提升港区电动汽车使用率，同时增加充电桩

振华重工推出港口智慧能源解决方案，希望让港口能源供应更清洁，能源调度更智能，让年轻人愿意到港口工作，让老百姓愿意生活在有港口的城市，让港口成为世界的绿色窗口。

系统，提高清洁能源的使用率，降低能耗水平。

四是岸电系统方案。该方案使用了更为低价的新能源电力，让岸电使用具备经济性。在港口污染的制约下，很多国家开始研究岸电系统的使用，美国加州 2009 年出合法案，确定了 2020 年实现 80% 的船舶使用岸电的目标，中国也提出 2020 年 50% 以上港区具备向船舶供应岸电的能力。因此，推广港口岸电的使用刻不容缓。以 3 兆瓦岸电电源为例，投产后码头每年将减少有害物质排放 165 吨。因此，推广岸电能够有效减少船舶停靠期间对大气环境的污染，有效改善码头作业环境。

五是港口智慧能源综合监管平台。这也是智慧能源管理的核心系统，是兼具能源监控和统一调度等一系列功能的决策软件，清洁低价的能源供应通过这个平台实现合理供给。可以说，该系统是整个解决方案的大脑，融合了光伏、风电、储能、岸电等多种新能源，还可同时监控港口主要用能设备，与振华重工原有的自动化控

制系统无缝衔接，确保实现智慧能源的总体目标。应用智慧能源监控平台，可以使港口能源系统具备能源生产、存储、使用控制、设备用电优先级、基于费率的削峰填谷、负荷预测及负荷频率控制、发电成本和二氧化碳减排计算、主动孤岛和再并网等功能。此外，该平台还可对新能源、储能、电能替代、岸电系统四个能源解决方案进行有机结合，降低港口能源使用成本 15% 以上，提高能源综合使用效率 10% 以上，推动码头能源管控实现全面无人化、信息化、智能化。

振华重工自 2016 年起在绿色能源、节能减排领域进行了探索和实践，在分布式光伏、风电、岸电和储能等领域都有具体项目落地，在合作模式上，振华重工提供了 EPC 模式和 EMC 模式两种方案。

振华重工推出港口智慧能源解决方案，希望让港口能源供应更清洁，能源调度更智能，让年轻人愿意到港口工作，让老百姓愿意生活在有港口的城市，让港口成为世界的绿色窗口。■

智能化港口时代的 振华“转型”

整理 / 谭广仁

2018年11月7日至8日，振华重工主办的2018码头智能化解决方案交流论坛在泰国曼谷召开，备受业内关注。本次论坛以“聚众智、汇众力，推进码头的智能化建设”为主题，智能集卡、车辆调度系统、智能化维保平台等一系列创新技术在论坛上依次亮相，生动绘制了人工智能渗透下智慧码头的蓝图。以此为契机，振华重工党委书记、董事长朱连宇针对人工智能与港口发展发表了看法。



上海振华重工



2018 码头智能化 解决方案交流论坛

SMART TERMINAL SOLUTIONS FORUM

— 泰国·蓝菜帮码头 —

Thailand·Laem Chabang Port

2018.11.7



图为振华重工党委书记、董事长朱连宇在论坛上发表演讲。



问

这次论坛的成功举办引起了业内的广泛关注，这也是振华重工举办的第二届码头智能化解决方案交流论坛。继首届论坛后，振华重工的自动化码头业务进展如何？市场反响怎样？

朱连宇：2017年的今天，我们在上海成功举办了首届码头智能化解决方案交流论坛。论坛上，我们提出振华重工已经具备仿真规划、港机设备、系统集成和运营维护的码头一站式解决方案的能力，并发布了Terminexus商业生态平台，依托互联网、物联网，搭建全球港机备件供应平台，开创备件服务管理新模式。我们“以用户的需求为中心，为客户创造最大价值”的理念，得到了用户和合作伙伴广泛而积极的响应。

上海论坛举办后，一批自动化项目迅速落地。印度阿达尼（Adani）集团决定由我们为其打造印度首个自动化码头；在青岛港自动化码头一期不断刷新世界纪录后，用户将二期工程项目再次交给我们；而作为全球单体最大的自动化码头，洋山港四期自动化码头自去年运营以来表现良好，吸引了行业的广泛关注，具有影响力的中国品牌、中国制造、中国服务、中国标准为全球智慧港口发展提供了先进样本。在自动化堆场改造领域，我们也在不断发力，中国唐山、意大利瓦多（VADO）、阿布扎比哈里发港等自动化堆场项目也在不断落地。越来越多的项目，见证着我们从单机设备供应商向系统集成总承包商转变，从传统的港口机械制造商向现代化智能化码头整体解决方案提供商转变。



问

振华重工在自动化码头等新业务领域发展迅猛，取得了一批发展成果，您认为其中关键的核心因素是什么？

朱连宇：2017年的论坛上讲过，总结振华重工的发展，离不开两个核心要素：一是持续创新，二是高度关注客户需求，现在我想再加一条，就是要紧密围绕全球经济的发展和行业发展的需求。振华重工的业务发展与布局，正是站在全球经济的发展和行业发展需求的战略高度仰望星空，站在用户需求的实际立场脚踏实地，通过持续不断的科技创新助推梦想的实现。为此，过去的一年我们继续加大科研投入，持续推进研究总院建设，建立专业的工程实验室，不断扩充博士后工作站，推动院士工作站建设，打造高端人才智库，引导更多优秀人才和智力向公司集聚，推动公司在各新型领域的技术发展。我们所做的一切，就是通过我们在技术上孜孜以求的创新，来满足乃至引导用户的需求，让用户有更加完美的产品体验。

问

您如何看待人工智能对港口行业发展的推动作用？



朱连宇：当前，人工智能技术正在向港口码头渗透，从全球视角来看，现阶段正处于智慧港口理论探索和建设发展的初期。我们预计，人工智能的发展将赋能港口的每个领域，成为助推全球智能港口建设的新的引擎。将人工智能技术应用到港口的生产计划与调度过程，可实现码头智能泊位调度、智能场地策划、智能设备调度等；码头生产组织的智能化应用，可实现最小化船舶在港时间，最小化堆场翻捣箱操作，最小化集装箱运输成本等，推动港口朝着智能、高效、安全、便捷、绿色发展的现代化港口方向迈进。

2018年9月，上海举办了2018世界人工智能大会。作为源于上海的重型装备制造企业，我们将充分利用上海为大力发展人工智能产业所提供的各项便利，与广大用户和合作伙伴一起，在港口码头的技术交流、数据共享、应用市场等方面开展交流合作，共享数字经济发展的机遇。



问

近年来，在企业转型升级方面，振华重工都进行了哪些方面的探索？

朱连宇：作为全球港口机械行业的领跑者，我们自信于为全球港口码头发展带来的贡献，同时也在不断思考，如何通过自身的积极努力，持续推动全球港口码头的变革。2018年4月，国务院总理李克强考察公司时对我们提出要求：不仅要生产一流的装备，更要努力创造品质一流的服务，加快制造业向制造服务业转型。事实上，近年来我们已经在按照既定战略推动公司变革，我们从关注规模速度

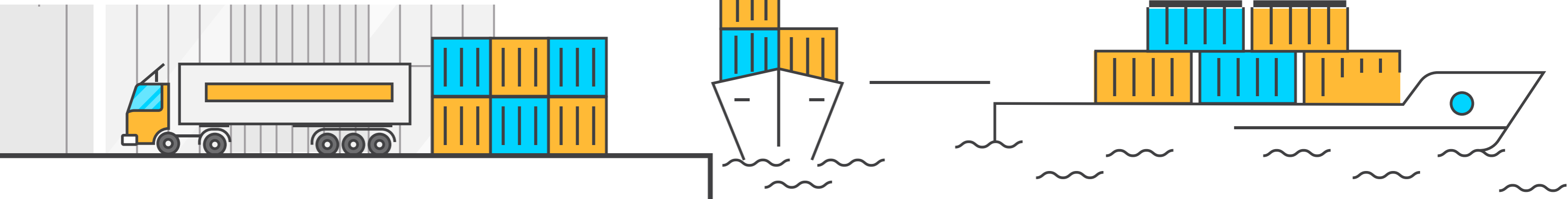
型增长，转向更加注重效益增长和效率提高；我们从注重产品数量，转向更加注重产品品质的改进，大力推进智能制造、精益制造和绿色制造，实现产业结构优化、国际竞争力增强和产业链提升；我们从侧重硬件投入，转向重视软实力建设，关注培育企业家精神、工匠精神和先进文化；我们从单一提供产品，向系统化解决方案转变，向服务型制造转变，推动优质高效多样化的供给体系不断完善。

（供图 / 李学民）

林查班的“码头革命”

ZPMC 为泰国打造首个远程操作自动化码头

文 / 袁 熠 慕立琼



未来，振华重工将继续完善岸桥远程及自动化轮胎吊系统，为码头提供更先进的自动化技术，进一步提高码头的运行效率和性能。

当清晨的第一缕阳光照在曼谷湾上，林查班港已忙碌了起来。五颜六色的集装箱从船舶卸下，集卡穿梭在堆场之间，轮胎吊精准地抓起集装箱迅速放入指定堆位，一系列高难度动作行云流水，一气呵成，而整个码头却空无一人。原来，这些设备是通过内部无线通讯和车身感应器等来自动引导，工作人员“躲在幕后”，在操作室内观察场内情况，并进行轻微介入。这里是和记黄埔的林查班港 Terminal D 码头，泰国首个采用远程操作系统的自动化码头。

林查班港（Laem Chabang Port）位于曼谷湾北部沿海，是泰国最大的国际深水港，同时也是一座与铁路、公路和内河运输网络相连的国际集装箱枢纽港。林查班港 Terminal D 码头是和记黄埔建造的无人集装箱码头，全长 1.7 公里，分三个阶段运营，计划于 2024 年全部完工，届时年吞吐量将达到 350 万标准箱。长久以来和记黄埔林查班码头与振华重工保持着良好的合作关系，迄今为



止，振华重工已经为其提供了 15 台岸桥和 35 台轮胎吊。

轮胎吊的结构特征决定了实现远程自动化的难度更大，但轮胎吊的灵活性高，相对造价低，市场需求量大。2016 年 9 月 27 日，和记黄埔与振华重工合作打造林查班自动化轮胎吊堆场，这是振华重工首次为全新码头提供自动化轮胎吊系统，也是全球第一个全程操控岸桥和自动化轮胎吊形

式的自动化码头。

自动化轮胎吊的人机交互作业环节较多，安全是其面临的巨大挑战。为降低安全隐患，项目团队多次与拥有丰富码头运营经验的和记黄埔沟通交流，开展风险评估，进行系统评审。在技术骨干江灏等人的带领下，研发团队不惧困难，一遍遍按照用户需求修改流程，完善设计方案。“虽然是第一代系统，但我们力求做到完美，不断反思和修改设计方案，最终获得了用户的认可，我们这支年轻的队伍也得



以迅速成长。”项目总负责人杨育青自豪地说道。

与传统码头相比，自动化码头的人工将减少约 25%，加上大部分工作是在操控室里完成，因此工作同样适合女性和年长者。目前，泰国劳动力紧缺，自动化码头的建成将为女性和年长者带来工作机会，提高了就业率。

2018 年 6 月 18 日，由振华重工为和记黄埔泰国林查班 Terminal D 设计制造的 3 台远程岸桥及 10 台自动化轮胎吊完成首次实船作业，15 小时完成 950 个自然箱的操作。这是全球首艘由岸桥远程操作并配备自动化轮胎吊装卸完成的船舶，备受业内瞩目。之后，和记黄埔决定向振华重工采购自动化轮胎吊，用于巴基斯坦、阿曼等码头。

未来，振华重工将继续完善岸桥远程及自动化轮胎吊系统，为码头提供更先进的自动化技术，进一步提高码头的运行效率和性能。依托丰富的自动化产品经验和强大的电控系统优势，自动化轮胎吊将可能成为振华重工新的业务增长点。

（供图 / 梅涵 吴思驿）

打造华盛顿州的新地标

文 / 李雪娇



在振华重工长兴分公司，一辆货车停在钢结构车间门口，车上装着一批长短薄厚不一的H型钢构件。每个身上都贴着一张巴掌大小的“身份证”，上面印着项目名称、构件名、构件号、长度和重量，还有一个大大的二维码。工人刘师傅掏出手机，对着二维码扫了一下，手机软件上立刻显示出从“型材预加工工序”到“装焊”的流程图，表示该构件正处于“装焊”阶段。

“这个二维码就是跟踪器，手机一扫，我就能看到这个构件所有的信息和工序状态，在不同阶段用不同颜色标识，一目了然。”刘师傅介绍道。

这是振华重工为华盛顿州会议中心附属大楼钢结构项目量身定制的管理软件，该项目共有18000多个构件，仅各类H型钢材就有257种。“要是没有系统工具来管理，不是乱套了吗？”按照传统的



现场管理方法，需专人每天对车间所有构件的生产状态进行统计，人工输入表格，费时费力还容易出错。为了解决这个痛点，振华重工项目组采用谷歌跨平台开发技术，开发了生产管理软件。像刘师傅一样，每道工序的工人都能将构件状态按照“开始制作”、“制作完毕”、“检验合格”三个阶段自行扫码上传系统，管理人员在后台实时跟踪构件生产情况，及时进行资源调配，提升管理效率。

华盛顿州会议中心附属大楼位于西雅图市中心，地上14层，地下2层，落成后将作为当地的标志性建筑。振华重工承担全部近19000吨钢结构的制作和运输。此前，振华重工在欧美国家曾打造过美国旧金山—奥克兰新海湾大桥、拉斯维加斯摩天轮和英国昆斯费里大桥等地标建筑，但这一次，是振华重工首次挑战国外建筑类钢结构项目。

“华盛顿州地处美国西部环太平洋地震带，项目的抗震要求很高，相当于可抗国内八级地震。”项目总指挥胡文佳介绍说。项目组首要面对的是他

们不熟悉的北美工艺规范。“胡总，我们以前从来没有用过这个规范，有难度呀！”“没事儿，就把它当个硬骨头，一点点啃呗！”胡文佳为工程师们鼓劲儿。“这个规范对关键焊缝的填充金属有附加要求，对焊材热层间温度控制也有要求……这么多的要求，需要我们对每条焊缝追根溯源。”

与传统项目相比，华盛顿州会议中心的关键焊缝比传统项目高出近10%。为了确保焊接质量，60名焊工同时通过美国焊接协会和华盛顿州建筑官方协会组织的双认证考试才能上岗。

在车间现场，一个正在运行的H型钢智能生产线引人注目。这个生产线由划线打标、三维钻孔、自动切割三个工作站组成，在国内也属首创。在智能生产线下，钢材的划线打标、钻孔和切割操作在机械臂下一气呵成，不仅节约了大量的劳动力，也提高了生产效率，首检和抽检合格率均已达到100%。

“以前是工人用尺子划，效率低，精度也不高。现在这个三维数控钻，精度能达到30-40丝，相当

华盛顿州会议中心附属大楼位于西雅图市中心，落成后将作为当地的标志性建筑。这一次，是振华重工首次挑战国外建筑类钢结构项目。

于四五根头发这么细。操作这条生产线，只要三个操作员加上两个起重工，最高的产量能达到一天80件。”胡文佳介绍说。

车间外的空地上，摆放着几个H型钢材试样，这是在项目开工前，项目组做的一批试制件，来检验设备和工艺是否可行。前不久，项目总包方项目总监凯蒂到现场考察，了解项目方案后称赞道：“亲眼看到了这些，我对振华重工的产品品质非常有信心！”

近日,振华重工“AGV大家庭”迎来了新成员——无托盘泊车 AGV。该 AGV 是针对汽车物流搬运业务研发的新产品,将广泛应用于港口、陆上汽车物流运输,准确无误地进行室外汽车驳运,是名副其实的“AGV 搬运工”,同时,最快时速可达 4 米/秒,是行业内的“最高速”。

据统计,2017 年全国汽车产销量首次突破 2900 万辆,相当于每天有近 8 万人从各个汽车品牌 4S 店提车。如此大的销量背后是强大的可遍布全国乃至全世界的汽车物流运输脉络。在汽车整车下线到 4S 店的物流过程中,至少需要 5 次转运,而国内目前大部分采用人工进行汽车转运工作。随

振华重工研制 新型室外汽车物流“搬运工”

文 / 王丛歌

着国内人工成本不断提高,实现自动化汽车物流运转已经迫在眉睫,为此,振华重工推出了无托盘泊车 AGV。

振华重工推出的“AGV 搬运工”拥有坚固、轻盈的“身体”。为了更好地传递自身牵引力和承载安装设备,设计师为无托盘泊车 AGV 设计了分离式的车体结构,包括舵轮安装架与举升车架,并使用举升导向销将它们连接在一起。同时,在安装架设计上应用了 C 型梁结构,并辅助加强筋,提高了刚度,可以更好地在受力时抵抗弹性变形。而举升车架采用一体化结构,则使 AGV “身体”减重不少,更加轻盈。

“AGV 搬运工”并不是四肢发达,头脑简单的



家伙,它拥有一个聪明的“大脑”,可以准备无误地进行搬运工作。在振华重工自主研发的无托盘泊车 AGV 调度系统的基础上,配合 UWB 定位系统,可以准确无误地接收指令,实现无磁钉精准定位,真正成为了一名听从指挥的合格“搬运工”。

作为一名“搬运工”,搬和运是其两大“使命”。无托盘泊车 AGV 可以将价值不菲的品牌汽车完好无损地送到目的地,这背后的“功臣”是振华重工自主研发的液压举升系统和牵引系统。

振华重工的液压举升系统采用了市面上少有的夹抱轮胎的举升方式。“AGV 搬运工”接收到“大脑”发出的指令后,行驶至指定取车位置,通过车身内

外的激光摄像头扫描要搬运的汽车轮廓,停靠在合适位置,前后 4 个液压夹臂托举机构配合举升系统将汽车轻松举起。此外,为了适用于不同轴距的汽车,设计师将位于后面的 2 个液压“手臂”设计在固定位置,2 个前臂配上伸缩油缸,可以“伸缩自如”地调节中心距离,满足了轴距为 2750-3200 毫米汽车的搬运。

“AGV 搬运工”不仅在“搬”上具有明显特色,

“运”的能力同样毫不逊色。负责“运”的牵引系统采用了前驱后定的布置方式,前部配置 2 台自带转向机构的驱动轮,可实时调整舵机转角,进行小转弯半径的转动,并配置了实时速度监控、耐磨材质;后部采用振华重工自主研发可举升定轮结构,在前驱后定的控制下,“AGV 搬运工”可以正着走、倒着走、转弯走,成为一个灵活的室外汽车驳运“机器人”。



“地龙芯”首克我国海底硬岩施工难题

图、文 / 保建军

对于垂直钻机，很多人顾名思义地理解为把盾构机竖起来，但一横变一竖颠覆了很多以往设计和制造理念。

近日，振华重工南通传动成功设计制造出国内最大功率的嵌岩单桩垂直钻机核心部件——驱动部，而这颗“地龙芯”的成功制造，解决了海上风电施工硬岩上插桩的难题，加速了中国海上风电施工挺进硬岩海底区域的步伐。

海上风电是清洁能源的重要来源之一，在我国南部，如福建沿海，坚硬的海底岩石阻碍了插桩施工。曾有专家建议仿照金属加工“在圆弧上钻小孔开大洞”，但未有成功应用的先例。

“如今，只要我们在驱动部上装上钻架、配上刀盘，就能像盾构机一样铣削出直径约 13 米的空洞。”设计师钱瑞说。

在设计初期，受限于整体重量和尺寸要求，驱

动部要求“既要马儿跑，又要马儿足够小”，因为驱动部体型大、自重剧增，这使得施工船体的负担增加和各个关节的受力剧增。

为了实现小身板大动力，钱瑞先是通过 6 个电机来实现动力驱动，“好比大家抱团发力”，有效缩小了“体型”；同时为了确保关节强度，钱瑞在输出轴上布置了特殊的轴承，让关节能拎起自己和刀盘。

在驱动部的加工上，难题集中在特殊的材料和极为苛刻的精度要求。为确保箱体强度，驱动部用铸铁箱体替代了焊接式箱体，这给加工带来了巨大的压力，不可补焊、不容出错，微小缺陷就可能导导致价值几十万的箱体报废。

“一要确保加工达到要求，二要防止加工中的意外，比如断刀、圆孔变形等问题。”谈到当初接手这个直径近 4 米、合箱后高 2 米重达 30 余吨的大



“地龙芯”的成功制造，解决了海上风电施工硬岩上插桩的难题，加速了中国海上风电施工挺进硬岩海底区域的步伐。

家伙时，箱体加工车间经理周骏仍心存敬畏。

为了防止断刀，周骏和团队专门采购了加工铸铁的刀片来替换普通刀片；为了避免圆孔加工成椭圆或喇叭形，兼顾加工面粗糙度要求，周骏和团队便制定专属的加工方案，保证了圆孔的精确度。

其中，箱体的主轴孔是“抱住”主齿轮轴的关键，主轴孔在上下两个箱体上，有6人餐的圆桌大，两孔之间大约有一张办公桌的距离。中心偏差却只允许在0.05毫米内。“比针尖对麦芒还难。”周骏说，“找一个空心的圆心已经很难，空心对空心，连线还得和壳体垂直，这个加工难上加难。”

主轴孔完成后，还得确保箱体在变形范围内加

工其他齿轮孔，每一步都要小心翼翼。匠心加技艺，保证了加工任务的完成。

所有的加工完成后便是装配，而装配的难题来自一个直径近一人高的轴承。“这种大尺寸轴承市场上完全没有，国内也第一次做，我们的制作也是找轴承厂定制。”钱瑞说。

为了解决这个难题，钱瑞、马润和资深装配高级钳工黄裕发通过研究，给轴承外圈配上专用活动地“座椅”和可伸缩“手臂”。在装配中，先用手臂托起加热后的轴承外圈，并将其放在座椅上，再套上滚子，等外圈冷却后让外圈自动缩回去，巧妙地让轴承外圈准确地进入规定位置。

最终，“地龙芯”通过多部门齐心协力，钱瑞团队承受住了考验，顺利完成了制作。振华“地龙芯”的研发，将会为海上风电施工，特别是硬岩海底施工提供高效的工具。

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中企自动化设备“武装”泰国码头

文 / 《环球时报》赴泰国特派记者 范凌志

在空无一人的码头集装箱堆场，将货柜以误差小于3.5厘米的精度抓起并放入指定堆位，这一系列高难度动作，都由控制室里小小操作台完成，而这个操作台甚至无需工人全程值守。8日，《环球时报》记者在振华重工提供自动化设备的泰国第一大港蓝菜帮港的Terminal D码头见证了这极富未来感的工作场景。振华重工董事长朱连宇表示，港口是世界经济的晴雨表，是对外开放程度最直观反映，振华重工将积极推动全球港口的升级换代，坚定支持经济全球化的发展。

“游戏级控制”实现货柜自动入位

从泰国的旅游胜地芭堤雅沿海岸线向北25公里，就到了位于春武里府的蓝菜帮港，这里自古就是海上丝绸之路的重要节点。据了解，蓝菜帮码头Terminal D是振华重工在泰国境内第一个采用远程操控岸桥及自动化轮胎吊的全新码头，预计2024年全部建成后将达到350万台标准箱的年吞吐量。

进入码头区域，明显感觉这里的工作人员非常少，站在控制塔台落地玻璃前，视野豁然开朗，跨度1.7公里的蓝菜帮码头Terminal D尽收眼底。码头运行有条不紊，控制中枢的设备仅仅是两个“游戏摇杆”配上几块显示屏幕，仿佛电子游戏的操作平台。

振华重工电气集团市场专员王琛向记者介绍，从货柜从船舶卸下，到集装箱卡车找到堆场位置，再到轮胎吊将货柜抓起精准入位，都通过内部无线通讯和车身感应器等一双双“眼睛”来自动引导，而工作人员可以在操作台上观察场内情况，并进行轻微介入。

程序如此智能化，那全自动精准入位的过程中什么时候才需要人工介入？振华重工电气集团技术研发中心总经理助理江灏告诉《环球时报》记者：首先，集装箱卡车停在堆位旁，轮胎吊会自动下降到距地面约6米的安全高度，这时需要人工操作将货柜抓牢再闭锁，然后把货柜拎起来到大概6米高的位置，在操作台按下释放指令，后面的程序就会

令货柜全自动精准入位，误差小于 3.5 厘米。“全自动化码头非常省人工，本来一个操作台就需要一个人，现在三台机器才需要一个人，甚至一个人控制五六台都可以。”

江灏告诉《环球时报》记者，这是全球范围内第一个采用自动化轮胎吊的项目：“跟轨道吊相比，轮胎吊成本较低、转场更灵活。”

因地制宜解决码头基建方案

在振华重工 11 月 7 日在曼谷举行的“2018 码头智能化解决方案交流论坛”上，振华重工首次发布全新一代的自动驾驶无人跨运车、智能集卡系统解决方案及无人机巡检系统。

《环球时报》记者注意到，此次参会的 200 余名来自全球 80 余家码头的运营商大多数来自发展中国家。总部位于阿拉伯联合酋长国的阿布扎比码头首席技术官 Angelo 告诉《环球时报》记者，他的

公司上周刚与振华重工签署一项设备采购合同用于港口扩建项目。对于升级港口的详细计划，他表示“我现在正在比较振华重工和其他公司提供的解决方案。”

目前，振华重工海外布局已经扩展到 101 个国家，而每个国家的实际情况和成本预期并不相同。振华重工跨运车项目研发经理胡中望在接受《环球时报》记者采访时表示，针对不同的港口规模和用户需求，一些港口无需增加基建成本，将开放道路的自动驾驶汽车技术移植到码头封闭道路上是未来的趋势之一。

自动化码头是未来的方向

有数据统计，全球已建成的自动化集装箱码头有 32 个。自动化集装箱码头最早出现在国外，1993 年世界上第一座自动化集装箱码头荷兰鹿特丹港建成，随后英国伦敦港、日本川崎港、新加坡港、德国汉堡港等港口也相继建成自动化集装箱码头。随后经过 20 多年的发展和创新改进，目前自动化码头技术已经逐渐成熟和完善。

近年来，在陆续建设厦门远海集装箱码头、青岛港全自动化码头、上海洋山港四期等国内项目的同时，振华重工也陆续获得意大利 VADO、印度 ADANI 和泰国蓝菜帮等国外自动化堆场项目，以及近期的巴拿马 PCCP 码头系统总承包项目等。

在采访中，一些专家向记者谈到了未来智慧港口“跨国远程操控”的大胆设想。“利用时差，由一个国家的操作台来控制几个时区之外的码头，每个工作人员都可以朝九晚五地上下班，而码头则是 24 小时顺畅运转。”“我们一直在做这方面的探索。”王琛对记者说，以自动化轮胎吊技术为例，现在集装箱卡车纠偏时还需人为监控，以后还会把这个人工介入环节也去掉，实现彻底的无人操作。

ZPMC 国内首创雪橇随雪龙号赴南极科考

2018 年 11 月 2 日，雪龙号开启第 35 次南极科考之旅，由振华重工承制的首批 13 台雪橇产品跟随科考队一同开赴南极。该项目共包括 16 台雪橇，涵盖 4 种不同类型，分别为标准雪橇、大型雪橇、油囊滑板雪橇、油罐雪橇，均由振华重工独立研发设计。其中，大型雪橇和油囊滑板雪橇是振华自主研发的新型雪上运输装备，属国内首次研制，填补了该产品的国内空白，将推动南极运输装备向轻型化、多功能化发展。

该批次雪橇将为第 35 次南极科考队泰山站二期建设提供冰盖运输保障，要应对零下 40 度以下极端环境的考验。设计研发过程中，振华重工多次与极地研究中心科考人员交流设计细节、雪橇工作工况、使用环境等，采用新材料，



精准控制雪橇重量，保证设备的可靠性。这是振华重工首次涉足南极项目，标志着振华重工业务板块又迈入新领域。

(供图 / 张杰)

ZPMC 发布 数字化智能船舶全球维保服务平台

2018 年 11 月 23 日，ZPMC 正式发布 Terminexus 数字化智能船舶全球维保服务平台。

Terminexus 数字化智能船舶维保服务平台是基于互联网打造的数字化智能全球维保平台，可为船舶配套企业、船东、维修公司提供备品备件网上交易平台，设备配套企业提供线上维修指导，培训服务等。

该平台将三维可视化技术应用在船舶维保上，减少维保过程中的沟通成本、时间成本以及人员学习成本，从而提高维修作业效率，创造经济价值。同时，该平台为中国船舶及配套企业参与国际竞争提供了全球售后服务保障，突破中国企业走出国门无法提供全球售后服务的瓶颈。



ZPMC 与浦东交投签订 智能立体停车库 EPC 项目

2018 年 9 月，振华重工与上海浦东交投签订了智能立体停车库 EPC 项目。该项目将解决浦东交投内部员工及外部车辆停车困难的问题，已于 10 月全面开工。

振华重工智能停车库技术与产品已成熟并在市场上得到充分验证。此次为浦东交投打造的停车库将为浦东交投增加 34 个可用车位，最大程度节约了停车位占地面积，大大缓解交投内部的停车状况。

ZPMC 进博会签下近 15 亿元采购大单

2018 年 11 月 9 日，在首届中国国际进口博览会上，振华重工与瑞士 ABB 集团、德国 BUBENZER 公司、瑞典 BROMMA 公司、美国 Phoenix 公司、瑞典 SKF 公司、德国 Igus 公司等 6 家供应商累计签订了近 15 亿元人民币的采购合同，涉及电控系统、制动器及联轴节部件、港口起重机吊具、港口起重机投光灯、轴承、拖链等商品类别。

首艘国产豪华邮轮建造合同签署

2018年11月6日，中国船舶工业集团有限公司与美国嘉年华集团、意大利芬坎蒂尼集团在中国首届国际进口博览会上，签订了2+4艘Vista级13.55万吨大型邮轮建造合同，并举行了邮轮建造项目启动仪式，标志着中国首艘具有世界先进水平的大型邮轮开始实质的设计建造。

该邮轮总长323.6米，最大船宽达37.2米，船高72.2米，最大吃水8.55米，最大航速22.6海里/小时。船上客舱配备达2000多间，其中套间34间，阳台房969间，海景房287间，内舱房826间，阳台房比例达47.7%，最大可载乘客5260人。邮轮有高达16层的上



该邮轮总长323.6米，最大船宽达37.2米，船高72.2米，最大吃水8.55米，最大航速22.6海里/小时。

层建筑生活娱乐区域，拥有大型演艺中心、大型餐厅、特色餐馆、各色酒吧、咖啡馆、购物广场、艺术走廊、儿童中心、SPA、水上乐园等丰富多彩的休闲娱乐设施，是一座名副其实的豪华“海上移动度假村”。

中集来福士建造全球最大深水养殖工船

2018年11月6日，中集来福士为Nordlaks公司建造的全球最大最先进的深水养殖船——Havfarm 1深水养殖工船项目正式开工。

Havfarm 1深水养殖工船项目总长385米，型宽59.5米，型深65米，包含6座深水网箱，养殖规模超过1万吨三文鱼。该工船装备全球最先进的三文鱼自动化养殖系统，可以实现鱼苗自动输送、饲料自动投喂、水下灯监测、水下增氧、死鱼回收、成鱼自动搜捕等功能。

科尼将交付地中海地区最大移动式港口起重机

Lorenzini & C. S.r.l. (Lorenzini) 在今年第三季度订购了一台科尼Gottwald Model 8移动式港口起重机。这台起重机将于2019年1月在意大利Livorno投入使用。

这台Model 8起重机将直接在客户现场进行安装和调试，并将为运输集装箱、轮式货物和车辆的集装箱船和ConRo船提供服务。同时这台柴油电动移动式港口起重机未来将与码头的电网相连接，操作更高效节能。

中国首台铁路双线超大直径泥水平衡盾构机成功穿隧

2018年11月1日，在河南郑州的豫机城际铁路施工现场，直径达12.81米、长约78米的“巨无霸”——“中原一号”盾构机破土而出，标志着中国首台铁路双线超大直径泥水平衡盾构机成功穿越该线重点控制性工程3.8公里隧道。

该设备自2017年1月始发以来，至今攻克了一次性长距离穿越复杂地段、成功下穿南水北调主干渠等难关；创造了单日掘进22米、月掘进410米、一次性安全掘进3800米等多项中国城际铁路大直径双线掘进新纪录。

**直径达12.81米
长约78米的
“巨无霸”**

Smart port: promising future of port

by Li Xuejiao

Ports, as vital infrastructures for regional economic development, provide the important support for economic development strategies of coastal provinces and those along rivers. Applications of IT technology and intelligent technology have been growing explosively recently and have been the most active factors in the traffic field. The smart logistics development requires the further upgrading on the port logistics and the smart ports have been the new trend for the port development.

What is the smart port? It means the new state of modern port transportation with distinct characteristics of smart production, intelligent management, flexible services and strong support to make higher port resources optimization and configuration and to meet higher service requirements of multiple levels, rapidity and high quality. It is based on the modern infrastructures and equipment with the new generation IT technology of cloud computing, big data, Internet of Things, mobile Internet and intelligent control integrated deeply with the port transportation as the core, which is driven by the innovation of the port transportation organization and services and supported with the complete systems and mechanisms, laws and regulations,

standards and codes as well as the development policies.

There is no doubt that the smart port is the development direction of ports in the future with new opportunities and possibilities. The scientific development has provided the foundation for the construction of the smart port at present. In the new transformation, the strategic focuses of the port turn from the resource control to the lean resource management, from the optimization of internal procedures to more external interaction and from adding customers' values to maximization of ecological system values.

It is complicated to construct the smart ports, requiring participation of different parties. ZPMC, leading in the port machinery, has been providing Zhenhua programs for the smart ports of the globe with advantages of brand, innovation and platform integration as well as wisdom and strength of related parties.

The smart port will develop to be more efficient, safer, greener and intelligent in the future. The Internet of Things reduces the construction costs of automatic terminals, promising the smart port is around the corner.



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振华重工

November / December 2018
Volume 30 Issue 2 2018

Published by ZPMC

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Printed by Shanghai China Printing Co., Ltd.



Internal data Free exchange

ZPMC's intelligent vertical parking garage supporting green traffic

ZPMC struggling for one-stop solution on automatic terminals

by Zhang Jian Vice-president of ZPMC and Chairman of Smart Group

Technology of Internet of Things, AI, edge computing, block chain and 5G communication develops rapidly in 2018, leading a new industrial reform. The reform and innovation are spreading on ports and terminals and it's a consensus of the port industry on the transformation from mechanical age to AI age. ZPMC has been thinking and exploring in terminal automation and promotes the one-stop solution on automatic terminals.

One-stop solution on automatic terminals

ZPMC provides the one-stop solution on automatic terminals, including the planning simulation in the primary stage of the project, the equipment manufacturing and system integration as well as the operation maintenance after putting into production. Such solution has been used in many projects, winning the acceptance of the market.

Terminexus platform by ZPMC was put into operation in 2018 and ZPMC has signed VMI contracts on spare parts supply and purchasing contracts on the second-hand equipment with SIPG, Maersk, Hutchison Ports and China Merchants Port Holdings Co., Ltd..

ZPMC signed the automatic terminal system general contract with Adani Group India on Dec 20th, 2017, which is the largest

contract by and between ZPMC and Adani since starting mutual cooperation and the terminal is the first automatic one in India. ZPMC provided regular automatic port machinery, equipment control system (ECS) and the integration of related subsystems of terminal operating system (TOS), gate operating system (GOS) and refrigerated container monitoring system (RMS) as well as spare parts supply for the operation of terminals in the project. The successful launching of the project shows the one-stop solution on automatic terminals by ZPMC is accepted on the market, which is a milestone for ZPMC in the field of automatic terminals.



The reform and innovation are spreading on ports and terminals and it's a consensus of the port industry on the transformation from mechanical age to AI age.

New records on the operation efficiency have been made since the commencement of Qingdao Automatic Terminal Phase I on May 11th, 2017. Qingdao Port experienced the efficiency and benefits of automatic terminals from the huge success of Qingdao Automatic Terminal Phase I. Qingdao Port Group signed another contract with ZPMC on Sep 8th, 2018, starting the Qingdao Port Automatic Terminal Loading and Unloading System General Contract Phase II, which has been developing smoothly until now.

Shanghai Yangshan Phase IV automatic terminal, the largest single body in the globe, started the operation officially on Dec 10th, 2017. Which completed 2 million in 2018, and was planned to completed 3 million TEU in 2019. It will expand the scale increasingly for the annual capacity of 6.3 million TEU with 26

STSs, 120 RTGs and more than 130 AGVs.

ZPMC won the contract on the container yard automatic restructuring of Tianjin Wuzhou International Terminal on Feb 12th, 2018, indicating a key step of the Company in the field of automatic container yard restructuring. It is the first large container yard automation restructuring project in China. Meanwhile, ZPMC made optimization on the dispatching module of the automatic container yard with the cooperation with Tianjin Port IT Development Co., Ltd.

ZPMC provided the automation restructuring on the traditional RMG container yard for Shanghai Zhendong Container Terminal, which was put into operation in November 2016 with the maximum operation efficiency twice as much as the previous

efficiency. Zhendong Terminal started the construction of Phase II at the end of last year and the Phase III is under planning at present.

Besides, there are larger quantities of automatic terminals under planning, for which ZPMC are providing customized solutions. ZPMC establishes the unique characteristics on the automatic terminal solutions finally after the communication with customers.

Forward-looking and thoughts on port intelligent development

The development of automatic and intelligent terminals is in close relation with the technical development. The breakthrough of techniques of sensing, mobile equipment, video analysis, RFID, UAV, 3D printing, 5G communication, cloud computing, AI, network transmission, network safety and new energy will promote the application of new techniques on different procedures of terminals. ZPMC, as an equipment manufacturer and system provider, is making research, design and test with partners, applying new techniques into the updating and upgrading of the equipment and systems, reducing costs of the equipment and systems and improving the intelligence of the systems and the safety of the equipment.

The Company is testing different vehicle wireless positioning technology to reduce the requirement of magnetic nails on the infrastructure of terminals. ZPMC is testing the large vehicle anti-collision program with integration of video, laser and ultrasonic wave to make sure safer RTGs collision avoidance. The Company, together with partners, developed the UAV steel structure tour inspection system for the convenience of customers.



ZPMC is testing and verifying the passive optical network (PON) system in the automatic terminal systems to improve the speed and stability of the communication and to reduce the costs of the communication systems as well. The Company is developing the automatic unlocker to reduce the unique site operator on automatic terminals, on which a certain progress is made.

With the increasing growth of the manpower costs and costs of fuels for the horizontal transportation on ports, the safety and efficiency of the transportation is the concern of port users. ZPMC develops the unmanned straddle carriers and unmanned container fleet with the cooperation with famous unmanned technology companies in China, realizing different functions of automatic traveling, accurate stop, loading and unloading of containers, avoiding obstacles, overtaking and changing lane as well as joint operation of different vehicles, thus, promoting the intelligent restructure of the port horizontal equipment greatly.

ZPMC developed the automobile intelligent storage program with the intelligent garage as the core for the increasing business of automobile rolling on and off terminals. The warehouse care is made in the intelligent garage to keep new automobiles from wind, rain, sand, dust and salty fog to provide maximum protection, compared with traditional ground yard or self-moving parking building. Meanwhile, the occupying area of a single carport reduces from the common 17-24m² to 2.2m². The real time IT management is also made on the stock and cargo positions to reduce the quantity of workers and human error, making sure the accurate and real time cargo management and loading and transportation plans. The automatic storage method replaces the manual parking, reducing the strength and improving the operation efficiency greatly. ZPMC has owned various techniques of intelligent garage and has provided mature programs for different automobile rolling on and off terminals at home and abroad.

The competition on ports at present involves not only on infrastructures of water depth, large berth and container yard, collection and transportation system, but on soft capacity on the supply chain and logistics of ports as well. To develop the soft capacity, it requires high and new techniques of Internet of Things, big data, cloud computing and AI to optimize the port collection and transportation system, improve the loading and unloading procedures and handling efficiency, thus, reducing the berthing time of vessels and operation costs of liner companies. The perfect combination of software and hardware can optimize and



The competition on ports at present involves not only on infrastructures of water depth, large berth and container yard, collection and transportation system, but on soft capacity on the supply chain and logistics of ports as well.

improve the infrastructures and management mode of ports, resulting in innovation on functions, techniques and services of ports, thus, making ports with the intelligent capacity. It has been an important way for ports to improve competence and to take opportunity for development as well as to improve the international competence of ports.

With the further research on intelligent terminals, we discover all we do at present is only the beginning of the intelligent terminal construction. The equipment layer should be more efficient and environment friendly, the information layer should be communicated in larger range and the plan layer should be

more intelligent in judgment and prediction. Therefore, the whole system should be more coordinated and efficient. Much remains to be done in each layers, which is the reason why we advocate to construct an open and inclusive smart port ecosphere.

Looking forward, we find the adaptive changes of ports also provide wide platform for ZPMC and partners. We should cultivate new energy for the development of intelligent terminals with mutual advantages and collective strength, making the reform on the port and shipping industry bring about more welfare for people of different countries. 📷

(photo / Ji Xueqing Mei Han Li Xuemin)

Care for life cycle service system of equipment

by Zhang Yongxiu

“What shall I do in case of any fault beyond the warranty period of 2 years after purchasing the equipment?” , “It takes too much time for the engineer to arrive at the site in case of the fault of the equipment, impacting the construction period.” “It will take too much money and time to invite professional maintenance companies.” “Can't you extend the warranty period of the equipment? After all, it takes too much for us to develop our own maintenance team.” Cao Yongping always received such complaint emails within a few years of post-sales service in ZPMC. “However, it's unrealistic to extend the warranty period arbitrarily. We have to make amicable explanations to customers.” , said Cao with a forced smile.

How to solve such worries of customers on using the equipment? ZPMC made the market survey in the globe, focusing on main maintenance problems of customers and then promoted ZPMC Care+ service platform to provide the life cycle maintenance services for the equipment used in terminals.

ZPMC Care+ will provide life cycle care for the equipment from the beginning of the operation. UAV tour system replaces the traditional manual climbing in the regular inspection on the port machinery. In the latest test, the UAV can tour 40 overhead areas within 2 hours without dead corners, improving the tour speed of 8 times. The UAV tour system saves the manpower and eliminates the test blind area as well, with which the maintenance staff will not climb as the Iron Man any more. It's also unnecessary to input the test data manually after the tour inspection. “The front APP can plan the course automatically and the inspection data can be uploaded with one key. The background program in the system can make diagnosis on images and generate the assessment report synchronously, providing rapid assessment experience for customers.” , said Li Wenjun, R&D team member of the maintenance service platform.

The life cycle maintenance doesn't just mean the regular inspection. The precaution is equally important. To eliminate potential problems at the very beginning, ZPMC struggles for the equipment monitoring. Weiyi, Engineer of ZPMC Smart

Group, said: “The crane intelligent test system can make real time monitoring on the whole operation of terminals, supporting multiple data ports and historical replay to assist the customers for better understanding on the state of the equipment.” Meanwhile, the R&D team also adds the expert analysis on the basis of monitoring, displaying multiple key test points dynamically and making the health diagnosis on the equipment. ZPMC, with the support of the big data, made successful cooperation with Yangshan Phase IV automatic terminal to provide predictive maintenance on the equipment. “We search historical data of the equipment for accumulation and analysis to predict possible problems of the equipment and to make treatment in advance, thus, reducing the user's risk on using the equipment.” , said Yang Renmin, CTO of ZPMC Smart Group, “For example, we focus on main loading positions of STSs where the steel structure is easy for crack. The treatment in advance can reduce the using risk and extend the service life of the equipment.”

“The port machinery of ZPMC has high market share in the world and we will bear more responsibilities to perfect the maintenance on the equipment by the life cycle service system, thus, assisting customers to reduce the terminal operation costs and to improve the operation efficiency.” , said Cao Yongping. 张

(photo / Li Xuemin)



Invisible traffic warden

by Mu Liqiong

A group of intelligent carriers, including container trucks, Automated Guided Vehicle (AGV) and unmanned straddle carriers are working orderly from STSs to storage yard on the busy terminal. Suddenly, a container truck stops in the middle of the road. The trolley behind in operation is almost hitting the truck but it reduces the speed and turns to the low speed lane on the left naturally.

The crash accident is avoided thanks to the invisible traffic warden, the intelligent vehicle management system developed independently by ZPMC, which can guide the equipment of different levels on the terminal for stable and efficient operation. With the increasing development of technology, the horizontal transportation is more and more intelligent, which even can be equal to the human dispatching. However, there may be traffic jam due to vehicle deadlock as result of shortage of the system commander. “To be simple, the present transportation isn't so smart.” , said Wang Xiaojin, Person in charge of R&D of the intelligent vehicle management system.

How to make the horizontal transportation on the terminal more clever and smarter? Wang Xiaojin found that the traffic jam could be solved with a smart brain for general decision. ZPMC started to develop the intelligent vehicle management system fit for the positions with collective horizontal transportation, including terminals, logistics parks and airports, in the dual mode of strong brain and single body. The brain, as the general commander, is responsible for the general planning of comprehensive operation while the strong single body means the intelligent transportation equipment with a certain self-decision capacity. The computing capacity of the brain and the operation accuracy of the strong single body is integrated perfectly, which even can be higher than that between the dispatchers and operators, thus, improving the operation efficiency of terminals.

“The intelligent dispatching is the largest feature of the system.” , said Wang Xiaojin. The section can be crowded in case of more vehicles selecting the same lane when a container truck turns to the high speed lane. The vehicles can select different routes on the basis of actual traffic conditions with the system, avoid the longer way and partial traffic jam as well, thus, solving the traffic jam in the horizontal transportation on terminals.



The service life of the equipment can be extended with the intelligent vehicle management system. “The aging is natural for the equipment after putting into operation. It was safe for a certain vehicle to drive in a certain range previously. However, the aged vehicle requires more space to make sure safe driving. In such condition, the system can make automatic adjustment on the basis of actual using conditions of vehicles, which is called as high self-adaptability.” , introduced by Chen Bo, Engineer of the Project. The vehicle can decide whether to slow down with the predicted traffic jam time from the system in case of traffic problem in front during the operation, which can reduce the energy consumption due to frequent speed changing and unnecessary waiting time as well, thus, extending the service life of the vehicle.

The operation on terminals may be busy on one time while idle on other time. Accordingly, the intelligent vehicle management system has two modes. The energy saving mode of the system is used when the terminal is free to reduce the unloaded ratio and energy consumption while the highly efficient mode is used when the terminal is busy to make sure higher efficiency. The system is smart for its third balance mode when the brain can make optimal judgment on actual conditions of the site. The special safety mode is also set up in the system for unsafe conditions, including bad weathers.

The intelligent vehicle management system can be used in different projects and fields, such as warehouse, in the future. “Simply speaking, it's the optimization of different strategies to be fit for other projects.” , summarized by Wang Xiaojin. 张

Port—a green window of the world

Port intelligent energy solution by ZPMC

by Xu Xiaoyong

What are present conditions and the largest concern of the energy of ports? ZPMC made primary survey on the energy of the global ports and found three main problems. The first one is the high energy consumption and serious pollution. The pollutants from ports have covered more than half of the total local air pollutants in some port cities. The next problem is the requirement for power upgrading. With the increasing growth of the business, quite a few ports are equipped with more electric equipment and the promotion is made on changing oil into electricity and adding shore power supply, thus, requiring the upgrading and restructure of the power supply of ports. The last one is the high operation costs of ports due to high electricity prices. The electricity is 20 cents per kilowatt-hour in some ports, causing quite low utilization of green energy devices which have been installed.

To solve such abovementioned problems, ZPMC put forward the port intelligent energy solution, a comprehensive one on power generation, consumption and energy control, consisting of the following 5 parts:

New energy program, which means different types of renewable energies, including PV and wind power. The idle areas of roofs and open spaces in ports are made use of for distributed PV, wind power and natural gas stations to provide the clean and cheap energy. ZPMC also provide customized program on the basis of actual conditions of terminals with

small area and open spaces. The PV can not only be installed on the ground, slopes of mountains, roofs and water surface. It also can be installed as the curtain walls, roofs of carports and acoustic screens to make full use of the area of ports. The ports will have clean and cheap energy with the program.

Energy storage program, which is the pluralistic solution focusing on battery energy storage integrated with other new energy storage modes and the battery cascade utilization. The cascade utilization means the secondary utilization of storage components, including lithium battery, to be retired for further energy storage system. Such utilization can extend the service life of the lithium battery and reduce the investment costs of terminals as well. With the energy storage program, the adjustment can be made on the peak-valley power of ports to store the electricity of low prices, which can be used at the peak with high prices, thus, reducing the energy costs of the operation of terminals. Meanwhile, the requirement of transformers can be controlled with such energy storage program. The calculation is made on the peak electricity consumption of terminals to supplement the power supply for the peak, thus, reducing the further costs of power supply of ports and improving the stability of power supply.

Electricity alternative program which involves new energy vehicles and charging system to improve the utilization ratio of electric automobiles in ports. The charging system is also

ZPMC provides the port intelligent energy solution for cleaner energy supply for ports and more intelligent energy dispatching, wishing more young people to work in ports and more people to live in cities with ports, making ports the green window of the world.

added to improve the utilization ratio of clean energy and reduce the energy consumption as well.

Shore power system program, which make use of the new energy power with lower prices to provide the economic shore power supply. Many countries started to research the application of the shore power supply system under the restriction of the pollution in ports. The act was published by California government in 2009, formulating the target of 80% vessels using the shore power in 2020. China also set the target of more than 50% ports having the capacity to provide the shore power to vessels in 2020. Therefore, it's urgent to promote the application of the shore power supply in ports. The terminal can reduce the hazardous substances of 165t each year after applying the 3MW shore power supply. Therefore, the application of shore power supply can reduce effectively the air pollution of vessels during stay in ports and improve the terminal working conditions effectively.

Port intelligent energy comprehensive monitoring platform, which is the core of the intelligent energy management system and the decision software with functions of energy monitoring and uniform dispatching. The platform can provide clean and cheap energy reasonably. It can be said as the brain of the whole solution with integration of multiple new energies of PV, wind power, storage energy and shore power supply, which can also monitor the main energy using equipment of ports. It

also can be connected seamlessly with the original automatic control system of ZPMC, making sure the general target of intelligent energy. With the intelligent energy monitoring platform, the port energy system can have functions of energy generation, storage, application control, equipment power using priority, peak load shifting on prices, load prediction and load frequency control, calculation of power generation costs and reduction of CO2 emission, active islanding and reconnection of grid. Meanwhile, the platform can also make integration of 4 energy solutions of new energy, energy storage, power alternative and shore power system, reducing the energy application cost by more than 15% and improving the energy comprehensive utilization ratio by more than 10%, thus, promoting the unmanned, IT and intelligent control on the energy of terminals.

ZPMC started the exploration and practice in green energy, saving energy and emission reduction in 2016 and launched specific projects in distributed PV, wind power, shore power and energy storage. ZPMC can provide EPC and EMC modes for cooperation.

ZPMC provides the port intelligent energy solution for cleaner energy supply for ports and more intelligent energy dispatching, wishing more young people to work in ports and more people to live in cities with ports, making ports the green window of the world. 🌿

ZPMC transformation of intelligent port

Edited by Tan Guangren

2018 Terminal Intelligence Solution Exchange Forum by ZPMC was held in Bangkok Thailand in Nov 7th to 8th, attracting much industrial attention. A serial innovative techniques of intelligent container truck, vehicle dispatching system and intelligent maintenance platform appeared on the Forum with the theme of promoting the construction of intelligent terminals with all wisdom and strength, providing the blueprint of smart terminals with AI. Zhu Lianyu, Secretary and Chairman of ZPMC, took the opportunity to express his opinions on AI and port development.



上海振华重工



2018 码头智能化
解决方案交流论坛

SMART
TERMINAL
SOLUTIONS FORUM

— 泰国·蓝菜帮码头 —

Thailand·Laem Chabang Port

2018.11.7



Zhu Lianyu,
Secretary and
Chairman of
ZPMC, delivered
a speech at the
forum.



Q

This Forum attracts wide attention of the industry and it's the second terminal intelligence solution exchange forum by ZPMC. How does the automatic terminal of ZPMC develop? What's the response from the market?

Zhu: We held the First Terminal Intelligence Solution Exchange Forum in Shanghai at the same day of last year. On the Forum, we showed that ZPMC owned the capacity to provide the one-stop solution of simulation planning, port machinery, system integration and operation maintenance and published the business ecological platform --- Terminexus, a global port machinery spare parts supply platform on the basis of Internet and Internet of Things, initializing a new mode of spare parts service management. We adhere to the idea of creating maximum value for customers focusing on the requirements of users, winning the wide and active response from users and partners.

Many automatic projects were launched after the Shanghai Forum: Adani Group of India decided to appoint us to construct the first automatic terminal of India. New world records were made in Qingdao Automatic Terminal Phase II and the user appointed us for the second phase. Yangshan Automatic Terminal Phase IV, a largest single automatic terminal in the globe, has been performing well since the operation last year, attracting wide industrial attentions. The China Brand, Made in China, China Services and China Standards with great influence provides advanced models for the global intelligent ports. We have been working hard in the automatic yard restructure. Automatic yard projects in Tangshan China, VADO Italy and Abu Dhabi Khalifa Port are launching. More and more projects show that ZPMC has been transferring from a single equipment supplier to a system integration general contractor and from a traditional port machinery manufacturer to a supplier of modern intelligent terminal integration solution.



Q

ZPMC develops rapidly in new business, including automatic terminal, with many development achievements. What, do you think, is the key core factor?

Zhu: I once mentioned in the forum last year two core factors for the development of ZPMC, continuous innovation and high concern on customers' requirements. I'd like to add one, to focus on the requirements of the global economic development and industrial development. We develop our business and decide the arrangement with the strategy for the requirements of the global economic development and industrial development as well as the users' requirements. We keep making technical innovation to realize the dream of the Company. So we increased the technical investment last year, promoted the construction of the research institute, built professional engineering labs, expanded postdoctoral workstations, promoted the doctoral workstations, and set up the high end talent tank and attracted more excellent talents and intelligent to cluster to the Company, thus, promoting the technical development of the Company in new fields. All we do is to meet and guide the users' requirement with technical innovation and to provide the users with perfect product experience.

Q

What's your opinion on the promotion of AI on the port development?



Zhu: The AI technology is used gradually on ports and terminals at present. It is in the primary stage of theoretic exploration and construction of smart ports in the world. We predict that the AI will enable each field of ports as a new engine to promote the global smart port construction. AI technology in the production planning and dispatching of ports can realize the intelligent berth dispatching, site planning and equipment dispatching. The intelligent operation organization of terminals can make sure minimum port time of vessels, yard handling operation and container transportation costs, promoting ports developing to be intelligent, efficient, safe, convenient, green and modern.

2018 International AI Conference was held in Shanghai last September. We, as a heavy equipment manufacturer in Shanghai, will share the opportunity of digital economic development to exchange and cooperate with users and partners on the technical exchange, data sharing and application market with advantages on AI development provided by Shanghai.

Q

What has ZPMC done in transformation and upgrading in recent years?



Zhu: We, as the leader of the global port machinery, are confident for contribution for the development of ports and terminals in the world. We have also been thinking how to promote the reform of the global ports and terminals with positive work. Li Keqiang, Premier of the State Council, inspected the Company in the first half of the year and urged us to produce the first class equipment and to provide the first class services as well to speed up the transformation from the manufacture to manufacturing services. We actually started the reform in the Company with the established strategy recently. We transform from focusing on the scale and speed growth to focusing on

benefits and efficiency growth, from focusing on the quantity of products to focusing on the improvement of quality and promoting intelligent, lean and green manufacturing, realizing the industrial structure optimization, increasing international competence and improvement of industrial chain, from emphasizing on the investment on hardware to focusing on the soft strength, cultivating the enterpriser's spirit, workman spirit and advanced culture, from providing products only to providing systematic solution and service manufacturing, promoting the improvement of the supply system of high quality, efficiency and diversity.

(photo / Li Xuemin)

Reform of Laem Chabang Port

First automatic terminal under remote control in Thailand by ZPMC

by Yuan Yi Mu Liqiong



ZPMC will keep improving the STS remote control and automatic RTG system in the future to provide more advanced automatic techniques for terminals, making further improvement on the operation efficiency and performance of terminals.

When the first sunshine spreads on the Bay of Bangkok in the morning, Laem Chabang Port is busy in operation, where colorful containers are unloaded from vessels, container trucks are moving between storage yards and RTGs are picking up containers accurately and putting into appointed positions rapidly. However, there is no person working on the whole terminal. Such equipment are guided automatically with the internal wireless communication and sensors on vehicle bodies. The operators observe the scene on the site in the operation room with slight participation. This is Terminal D of Laem Chabang Port of Hutchison Ports, the first automatic terminal under remote control in Thailand.

Laem Chabang Port, located along the north coast of Bay of Bangkok, is the largest international deep water port in Thailand and an international container hub port for railway, road and inland water transportation. Terminal D of Laem Chabang Port is an unmanned container terminal constructed by Hutchison Ports with the total length of 1.7km with operation in three phases. It is planned to complete in 2024, when the annual capacity will be 3.5millionTEU. The terminal of Laem Chabang Port has been in sound cooperation with ZPMC and ZPMC has provided 15 STSs and 35 RTGs to the Terminal until now.

The structure of RTG means large difficulty of remote



automation. However, RTGs are needed more on the market for their flexibility and relatively low costs. Hutchison Ports and ZPMC constructed the automatic RTG yard in Laem Chabang Port on Sep 27th, 2016, the first automatic terminal with wholly controlled STSs and RTGs in the world. ZPMC provided the automatic RTG system for the brand new terminal for the first time.

Many human-machine operations of automatic RTGs means the safety is the largest challenge. To solve the possible safety risks, the project team made communication and exchange with

Hutchison Ports which has rich terminal operation experience and risk assessment for the system evaluation. The R&D team, under the leadership of Jianghai and other technical experts, made repeated modifications on the procedures according to the requirements of users for the perfect design program. "Although it is the system of the first generation, we still struggle for perfection and win the recognition from users with repeated reflection and modifications on the design program. Our young team grows rapidly.", said Yang Yuqing with pride, the general person in charge of the Project.



Compared with traditional terminals, automatic terminals will reduce the man power by 25% approximately. Much work is completed in the operation room. Therefore, such work can be finished by the females and the old. At present, the labor force is short in Thailand. The automatic terminal will provide the work opportunities for the females and the old, increasing the employment rate.

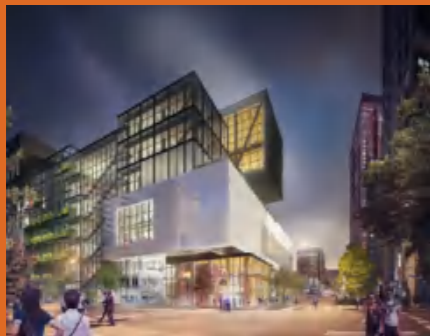
3 remote STSs and 10 automatic RTGs designed and manufactured by ZPMC for Terminal D of Laem Chabang Port Thailand of Hutchison Ports finished the first actual loading and unloading 950 natural containers within 15 hours on June 18th, 2018. It is the first vessel loaded and unloaded with automatic RTGs under STS remote operation in the world, attracting the industrial attention. Hutchison Ports then decided to purchase automatic RTGs from ZPMC for terminals in Pakistan and Oman.

ZPMC will keep improving the STS remote control and automatic RTG system in the future to provide more advanced automatic techniques for terminals, making further improvement on the operation efficiency and performance of terminals. Automatic RTGs with strong automatic product experience and advantages on the electrical control system will be a new business growth point of ZPMC. 🌟

(photo / Mei Han Wu Siyi)

New landmark of Washington State

by Li Xuejiao



In ZPMC Changxing Branch, a truck stops at the entrance to the steel structure workshop and the truck is loaded with H steel pieces of different length and thickness. Each structure is pasted with a hand-size ID card with the name of the project, name of the structure, number of the structure and its length and weight, together with a large QR code. A worker named Liu takes out his mobile phone and scans the QR code and the flow from “Structure pre-process procedure” to “Welding” displays on the mobile phone with the software, indicating such structure in the stage of welding.

“Such QR code is a tracker. Scanning with my mobile phone, I can discover all information and state of procedure of such structure, which is marked with different colors. It’s very clear.”, says Mr. Liu.

It is the customized management software by ZPMC for the steel structure project of accessory building of Washington State Conference Center, which has more than 18,000 structures and 257 types of H steel structures. “It will be disorderly in case of no system tools for management.” The traditional site management method requires the appointed persons for statistics



on the states of all structures in the workshop, inputting the tables manually. It takes much time and manpower and it’s probable to make mistakes. To solve such problem, ZPMC project team developed the production management software with Google cross-platform development technology. Just like Mr. Liu, the worker of each procedure can scan the QR code to upload the state of the structure to the system in three stages of “Begin”, “Complete” and “Qualified”. The management staff can make real time tracking on the state of structures on the background and make timely resources dispatching to improve the management efficiency.

The accessory building of Washington State Conference Center is located in the center of Seattle, with 14 stories on the ground and 2 stories under ground, which will be the local landmark after the completion. ZPMC manufactured and transported the total steel structures of 19,000t for the project. ZPMC once constructed landmarks of San Francisco – Auckland Bay Bridge, Ferris Wheel in Las Vegas in US and Queensferry Bridge in UK. However, it is the first time for ZPMC to complete foreign building steel structure project.

“Washington State lies in the circum-Pacific seismic belt in the west of USA, making high requirements on the Project, equivalent to the anti-seismic requirements of M8.0 earthquake in China.”, introduced by Hu Wenjia, General Commander of the Project. The first challenge to the project team was their

unfamiliarity on North America process codes. “Mr. Hu, we haven’t apply such code, it’s so difficult!” “No problem, just take it as a hard nut and crack it little by little!”. Hu encouraged the engineers. “This code makes additional requirements on filling metal for key welding seam as well as requirements on the temperature control on thermal layers of welding materials. To meet so many requirements, we have to track each welding seam.”

Compared with traditional projects, the key welding seams are 10% more in Washington State Conference Center. To make sure the welding quality, 60 welders have to obtain certificates from American Welding Society and Washington State Building Official Society before taking up the welding.

In the workshop, a H steel intelligent production line in operation is attractive, consisting of three workstations of lining and marking, 3D drilling and automatic cutting, which is initial in China. In such intelligent production line, the lining and marking, drilling and cutting of the steel are completed under the mechanical arm, reducing large quantity of manpower and improving the efficiency, with the qualified ratio of the first examination and sampling examination of 100%.

“The ruler was used for lining and marking manually with low efficiency and accuracy. The present 3D numerical control drill can make sure the drilling accuracy of 0.3-0.4mm,

The accessory building of Washington State Conference Center is located in the center of Seattle, which will be the local landmark after the completion. It is the first time for ZPMC to complete foreign building steel structure project.

equivalent to the thickness of 4-5 hairs. Such production line can be operated by 3 operators and 2 cranimen, completing 80 pieces each day maximally.”, said Hu Wenjia.

There are several H steel samples on the open area outside the workshop, which are the first trial pieces to test the equipment and process before the commencement of the Project. Katie, Project Director of the general contractor, made the site survey recently to learn about the program and said: “I’m quite confident on the quality of the products manufactured by ZPMC after I see this with my own eyes!”

ZPMC developed a new member of AGV family--- no-tray parking AGV recently, which is a new product developed for automobile movement in logistics widely used on ports and land automobile transportation for accurate parking of automobile outdoors. Its maximum speed can be 4m/s, the highest speed in the industry.

The statistics showed that more than 29million automobiles were sold in China in 2017 for the first time, which means nearly 80,000 people bought automobiles from different 4S shops of different brands every day. Such a large sale volume requires a strong automobile transportation system over China and even the whole world. The automobile is required for at least 5 transportation after the automobile moving off the production and arriving at 4S shops, which are mostly moved manually in China at present. With the increasing growth of the labor costs in China, it's quite urgent to make automatic automobile transportation.

New outdoor automobile porter by ZPMC

by Wang Congge

With the increasing growth of the labor costs in China, it's quite urgent to make automatic automobile transportation. For such purpose, ZPMC developed the no-tray parking AGV. Which is a new product developed for automobile movement in logistics widely used on ports and land automobile transportation for accurate parking of automobile outdoors.



For such purpose, ZPMC developed the no-tray parking AGV.

The AGV porter has a strong but light body. To transmit the self traction force and load the installed equipment, the designer designed the separate body for such parking AGV, including the steering wheel mounting frame and lifting chassis connected with lifting guide pin. The C beam with the strengthening ribs is used on the mounting frame to improve the rigidity to resist the elastic deformation under force in a better way. The integrated structure is used on the lifting chassis, reducing much weight of AGV, making it much lighter.

The AGV porter is not a strong guy with a simple mind. However, it has a clear brain to make accurate movement. The no-tray parking AGV dispatching system developed by ZPMC independently, together with UWB positioning system, can receive and send orders accurately, making sure no-magnetic nail accurate positioning. It is a qualified porter under the commands.

As a porter, it has to complete two major missions of movement and transportation. The AGV can send the automobile of high values to the destination safe and sound, which is supported by the hydraulic lifting system and traction system developed independently by ZPMC.

The lifting mode of hugging tyres is used in the hydraulic lifting system by ZPMC, which is quite rare in the market. When receiving the orders from the brain, the AGV porter will move to the appointed position to scan the outline of the target automobile with the internal and external laser cameras and stop at the appropriate position. It will lift the automobile easily with 4 front and rear hydraulic arms as well as lifting system. To move automobiles with different wheel bases, the designer designed the

rear 2 hydraulic arms at the fixing positions while 2 front arms with the telescopic cylinder to make free adjustment on the center distance, making sure the AGV moving automobiles with wheel bases of 2,750-3,200mm.

The AGV porter can not only move and also transport automobiles. The traction system for transportation is designed with the front driving and rear fixing arrangement, with two driving wheels of wear-resisting materials with steering mechanism at the front for real time adjustment on the steering angle for turning with a small bending radius under the real time speed monitoring. The rear fixed wheel by ZPMC is used for the lifting. In such control mode, the AGV porter can move forward, backward and make turning as a flexible outdoor automobile parking robot. 🤖

Drilling core-solving problem of submarine hard rock construction for the first time in China

by Bao Jianjun

Many people think the vertical driller roughly to be the vertical TBM. However, it subverts many previous design and manufacturing ideas.

ZPMC Nantong Gearing Branch designed and manufactured the core component of the rock-socketed single pile vertical driller— driving part with the largest power in China, solving the problem of maritime wind power construction piling on hard rock and speeding up the wind power construction on submarine hard rocks in China.

The maritime wind power is one of important sources of clean energies. However, the submarine hard rocks are obstacles for



The successful of manufacturing the core component of the rock-socketed single pile vertical driller, solving the problem of maritime wind power construction piling on hard rock and speeding up the wind power construction on submarine hard rocks in China.

piling in the south of China, such as those along the coastline of Fujian Province. Some experts once suggested to open a large hole by drilling small holes in arch, however, there is no successful precedent.

“Now, we can cut a hole of 13m in diameter in the earth after installing drilling frame and cutter on the driving part.” said Qian Rui, the designer.

In the primary design stage, the focus is made on the whole weight and size, requiring the driving part can work fast and keep possible small size as well. That’s because large size and high self-weight of driving part will add to the load of vessel and stress on joints.

To make sure large power with small size, Qianrui designed the driving part with 6 motors, reducing the size effectively. Meanwhile, to make sure the strength of joints, Qianrui designed special bearings on the output axle, making sure joints can lift themselves and the cutter.

Particular materials and extremely strict requirements on accuracy are main problems in processing the driving part. To make sure the strength of the tank, the casting iron box is used to replace the welded box in the driving part, adding great pressure on the processing, which requires no supplement welding and other errors. Otherwise, a small defect can cause the



abandonment of the box worth hundreds of thousands of Yuan.

"It requires the processing meeting the requirements and avoiding accidents in the processing as well, including broken cutter and deformation of round holes." When mentioning such a large pieces of 4m in the diameter and 2m height after closure, totally more than 30t, Zhou Jun, Manager of box processing workshop was still somewhat fearful.

To avoid broken cutter, Zhou Jun and his team purchased the special cutter for casting iron to replace the ordinary one. Zhou and his team also formulated special processing program to make sure the accuracy of the round holes and avoid processing the round holes into those of ellipse or trumpet.

The main axle hole on the box is the key to hugging the main gear axle. The main axle holes are on the upper and lower boxes. The holes are as large as dining table for 6 people with a distance of an office desk between them. However, the central error is only allowed for less than 0.05mm. "It's more difficult than pointing one needle to the other." Zhou Jun said, "It's really difficult to discover one hollow center of a circle. But we have to find two, of which the connecting line has to be vertical to the shell. It's much more difficult."

After processing the main axle hole, other gear holes have to be processed within the deformation range of the box, each of which should be made carefully. However, the spirit and technology of workers guarantee the successful completion of the

work.

The assembly is after all processing procedures. A bearing of the height of a people in the diameter in the key to the assembly.

"There is no bearing of such large size on the market and it's the first time to make such bearing in China. We appointed a bearing factory for customized manufacturing," said Qian Rui.

To solve the problem, Qian Rui, Ma Run and Huang Yufa, a senior fitter equipped special mobile seat and telescopic arms at the external cycle of the bearing after the study. The arm lifted the heated bearing external cycle and put it on the seat before setting the roller. The external cycle would shrink after cooling and the bearing external cycle was put into the stipulated position accurately in such a clever way.

Finally, Qian Rui and his team completed the work successfully with cooperation of different departments. The research and development of ZPMC drilling core will provide efficient tool for the maritime wind power construction, especially the submarine construction on hard rocks. 🚧



Coming of the smart port era

by Shen Weiduo and Fan Lingzhi in Bangkok Source:Global Times Published

Industry-leading ZPMC harbors intelligent solutions, strong competition

Amid a slowing port industry due to the growing anti-globalization factor in the international community, global port operators are ramping up efforts to promote the smart transformation, which could address some problems traditional ports are facing now. Shanghai Zhenhua Heavy Industries Co (ZPMC), the world's largest manufacturer of port machinery, is struggling to provide different smart solutions to its customers, in a bid to gain a stronger foothold in the coming smart port era.

At the autonomous container yard of the Laem Chabang Port, an unmanned crane is accurately stretching out to a container carried by a truck and putting it beside the many containers already piled at the yard block.

This is just one of the daily scenarios in the Laem Chabang Port, which is located 130 kilometers to the south of Bangkok and also the largest port in Thailand, supported by the autonomous system developed by Chinese State-owned Shanghai Zhenhua Heavy Industries Co (ZPMC).

With the new smart system, all Terminal D quay and yard cranes at the port can be operated by the advanced remote control technology.

Jiang Hao, assistant general manager of the R&D center at

ZPMC, told the Global Times on Thursday that the port is also the world's first fully automated yard block of ZPMC, which utilizes the automated rubber tired gantry (ARTG) for automated operation in the yard.

"Currently, prompted by the fast development of advanced technology including artificial intelligence (AI) and autonomous driving, port operators around the world are ramping up efforts to catch up with the coming smart era," Zhang Jian, vice president of ZPMC, told a port industry forum held in Bangkok on Thursday.

While Zhang cautioned that the transformation is more urgent now with the growing anti-globalization elements in the global market, which have brought some negative impacts to the growth of the global port industry.

"The golden era that has witnessed the fast development of the port industry has already gone; global ports operators are facing critical situations in making profits. Against this backdrop, transformation and innovation have become the consensus and a necessary move for ports all over the world," Zhang noted.

Smart transformation

Amid the fast development of smart transformation, ZPMC, the world's largest port machinery maker in terms of market share, has been stepping up efforts to develop and testing new

smart solutions for port operators around world, in a bid to gain an earlier foothold in this trend.

Apart from the latest smart port solutions used in the Laem Chabang Port, ZPMC also launched its intelligent container truck system on Wednesday, which could achieve a full automation of inner container trucks.

"The smart transformation of ports could greatly cut the number of workers needed at the site, thus the cost for that port might be reduced," Hu Zhongwang, straddle carrier R&D manager of ZPMC's port machinery group, told the Global Times on Wednesday, adding that a truck driver's annual salary in Europe could reach as much as 1 million yuan (\$143,740).

Wang Zhiqiang, manager of the production dispatching department of Jingtang Port, said that the automated terminal could also reduce work safety risks for drivers and increase handling efficiency.

"When manually driven trucks work in terminals, drivers will encounter many hazards and frequent interaction with cranes in a noisy environment. And truck drivers need to work during the night under high intensity, which can cause problems such as fatigue and the lack of concentration. These issues also increase the probability of incidents," Wang said.

ZPMC strength

Industry players told the Global Times on Thursday that

ZPMC has an advantage in leading the coming smart port era, but also faces strong competition in the industry.

The phase 4 of the Shanghai Yangshan Deep Water Port, supported by ZPMC's smart solution system, is now the world's biggest automated container terminal, and the phase 4 was put into operation in December 2017.

"The biggest advantage ZPMC has is its absolute leadership in the crane manufacturing industry, and it's creating a quite complete smart port solution," an industry insider, also a customer of ZPMC, told the Global Times on Thursday. The person asked to remain anonymous since he is not allowed to speak to the media.

According to the company's website, ZPMC's quayside container cranes and rubber-tired gantry cranes have a 70 percent world market share, and has remained to be the largest port machinery makers for 11 consecutive years.

"With the company's overwhelming share, people would prefer to adopt ZPMC's smart port solutions, especially when building a new port, since they will consider buying port equipment from ZPMC anyway," the insider explained, but mentioned that when it comes to the upgrading of traditional ports, ZPMC might face challenges from its counterparts.

One strong competitor is Finnish company Konecranes, a smart port solutions provider, which introduced the new generation of its ARTG system on October 31. Konecranes was the first company to develop an ARTG system on a wide commercial scale, according to a company statement.

Angelo de Jong, chief technology officer of the United Arab Emirates-based Abu Dhabi Terminals, who has cooperated with ZPMC since 2004, told the Global Times on Thursday that his company signed an equipment purchasing contract with ZPMC recently for port expansion projects.

However, for the detailed plans on upgrading the port, he can't make a final decision in the short run. "I'm now comparing solutions provided by ZPMC and other companies," he said, adding that ZPMC has a price advantage.

Despite a fierce competition, Zhu Lianyu, chairman of ZPMC, stressed the significance of cooperation and globalization at the preliminary stages of constructing smart ports.

"It's important for us to jointly promote the construction of global port terminals and establish an international standard for the technology of port equipment," Zhu said at the forum.

In the future, it is even possible that an operator could just stay in one country, while controlling different ports remotely across the world, said Wang Chen, a market specialist of ZPMC electric group. ☑

Sledges by ZPMC on Xuelong for Antarctic expedition

Xuelong started the 35th Antarctic expedition recently and the first batch of 13 sledges by ZPMC were on the ship for the Antarctic.

The project involves 16 sledges totally of 4 different types, common sledge, large sledge, oil flexible tank sledge and oil tank sledge, developed and designed independently by ZPMC. The large sledge and flexible tank sledge are new snow surface transportation equipment by ZPMC which is initial in China, filling in the domestic blank of such product. It will promote the Antarctic transportation equipment to be light and multi-purpose.

Such sledges will provide the ice sheet transportation to Taishan Station Phase II for the 35th Antarctic Expedition Team, to face the challenge of low temperature less than -40°C . ZPMC made several exchanges on details, working conditions and using conditions of sledges with the expedition team of the Polar Research Institute of China in the design and research. The new materials are used to control the weight of sledges accurately, making sure



the reliability. It is the first time for ZPMC to start the Antarctic projects, indicating a new business field of the Company.

(photo / Zhang Jie)

Digital intelligent vessel global maintenance service platform by ZPMC

ZPMC released Terminexus platform to provide the digital intelligent maintenance services for global vessels officially on November 23rd.

Terminexus is the digital intelligent global maintenance platform on the basis of the Internet, providing spare products and parts for vessel supporting companies, ship owners and maintenance companies and online maintenance guidance and trainings for equipment supporting companies.

The 3D visual technology is used on the vessel maintenance, reducing the communication costs, time and staff training costs, thus, improving the maintenance efficiency for economic values. Meanwhile, the platform provides the global after-sales services support for China vessels and supporting companies participating into the international competition, breaking the bottleneck of China's companies failing to provide after-sales services for foreign customers.



Intelligent vertical parking garage EPC project between ZPMC and Pudong Traffic Investment

ZPMC signed the contract on intelligent vertical parking garage EPC project with Shanghai Pudong Traffic Investment Co., Ltd. recently, which would solve the parking problem of the staff and customers of Pudong Traffic Investment. It was commenced last October.

ZPMC has mature techniques and products of intelligent parking garage, which have won adequate approval from the market. The parking garage for Pudong Traffic Investment will provide 34 parking places, saving the occupying area maximally and relieving the parking conditions of Pudong Traffic Investment greatly.

Purchasing order of nearly 1.5 billion Yuan by ZPMC on China International Import Expo

ZPMC signed purchasing contracts of nearly RMB ¥1.5 billion with ABB Group Switzerland, BUBENZER Germany, BROMMA Sweden, Phoenix US, SKF Sweden and Igus Germany on electrical control system, brake and coupling, spreader and light of port cranes, bearing and towing chain on the first China International Import Expo on November 9th.

Contract on 1st luxury cruise of China

China State Shipbuilding Corporation Limited (CSSC) signed the cruise purchase contract on 2+4 Vista large cruises of 13.55 total tons with Carnival Group US and Fincantieri Group Italy on the first China International Import Expo on November 6th, when the commencement ceremony of the cruise building project was held, indicating the design and building of China's first large cruise of the leading level in the world.

The cruise is 323.6m long totally, with maximum width of 37.2m, height of 72.2m, maximum draught of 8.55m and maximum speed of 22.6n mile/h. The cruise has more than 2,000 rooms, including 34 suites, 969 balcony rooms, 287 sea-view rooms and 826 cabins, of which the balcony rooms cover 47.7%. The cruise can hold 5,260 passengers maximally. It has the upper structure of 16 stories for



The cruise is 323.6m long totally, with maximum width of 37.2m, height of 72.2m, maximum draught of 8.55m and maximum speed of 22.6n mile/h.

living and entertainment, including large performance center, large dining hall, specialty restaurant, different bars, café, shopping mall, gallery, children's center, SPA and water park, which is actually a luxury maritime moving resort.

Commencement of largest deep water cultivation vessel in the world by CIMC Raffles

The commencement was made for Havfarm 1, largest and most advanced deep water cultivation vessel manufactured for Nordlaks by CIMC Raffles on November 6th.

Havfarm 1 is 385m long totally with the molded width of 59.5m and molded depth of 65m, consisting of 6 deep water net cages for more than 10,000t of salmon.

The most advanced salmon automatic cultivation system is equipped on the vessel, making sure automatic fry sending, fodder feeding, underwater light monitoring, oxygen adding, dead fish collecting and automatic adult fishing.

Kone will deliver largest mobile port crane in Mediterranean region

Lorenzini & C. S.r.l. (Lorenzini) ordered one Gottwald Model 8 mobile port crane from Kone in the third quarter of this year, which will be put into operation in Livorno Italy in January 2019.

The crane will be installed and debugged on the site of the customer for transporting containers, container vessel for wheel cargos and vehicles as well as ConRo vessels. Meanwhile such diesel-electric crane will be connected with the grid of the terminal in the future, making sure efficient operation with energy saving.

Mud-water balance TBM passing dual line super large diameter tunnel

The giant TBM, Zhongyuan No.1, of 12.81m in the diameter and 78m in the length passed the tunnel of Xinzheng Airport to Zhengzhou South Station in Henan Province on November 1st. It is the first super large diameter mud-water balance TBM passing the critical dual line railway tunnel of 3.8km in China.

The TBM has passed the long distance complicated section at one time and the main channel of south-north water transfer since January 2017. It made many new records of intercity railway large diameter dual line tunneling in China, including tunneling distance of 22m in a single day, 410m in one month and safe tunneling distance of 3,800m at one time.

Zhongyuan No.1, of 12.81m in the diameter and 78m

