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振华重工

SHANGHAI ZHENHUA HEAVY INDUSTRIES CO., LTD.

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主管、主办：上海振华重工（集团）股份有限公司

高质量发展的“数字化之翼”

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SHANGHAI ZHENHUA HEAVY INDUSTRIES CO., LTD.

"Digital Wings" boost high-quality development

《**风飘香袂空中举——荷花**》作者：徐梅

《**开拓创新**》作者：茆治

员工书画

共赴数字化转型新未来

文 / **薛韦慧**

习近平总书记强调“发展数字经济是把握新一轮科技革命和产业变革新机遇的战略选择”。当下，数字经济发展正成为重组全球要素资源、重塑全球经济结构、改变全球竞争格局的关键力量。

党的二十大报告提出，要加快建设网络强国、数字中国。根据国家《十四五规划和2035年远景目标纲要》和《十四五数字经济发展规划》，未来五年，我国将加快数字经济发展，充分释放数据红利，促进数字技术与实体经济深度融合，提高传统产业的数字化渗透率。今年2月，在党中央、国务院印发的《数字中国建设整体布局规划》中再次强调了“推动数字技术和实体经济深度融合”的重要性，并提出“在农业、工业、金融、教育、医疗、交通、能源等重点领域，加快数字技术创新应用”。

数实融合的画卷，在各行各业徐徐展开。制造业作为实体经济的重要组成部分正在与数字技术深度融合，实现更新换代，提升创新能力。制造业数字化转型，是推动业务与系统的双向融合，是战略主导下的业务变革，是数据驱动、智能助力的研发、生产、运营、服务改善，最终推进盈利模式优化和用户体验提升。它以数字化为核心，借助网络化手段，实现智能化赋能，保证产品和服务高效保质交付，持续提升企业核心竞争力。制造业数字化转型的关键是战略与组织能力协同、数字化能力建设、数字化转型价值闭环。

习总书记指出，“没有信息化就没有现代化”。振华重工在这一理念的引领下，积极融入国家数字经济发展大潮和行业转型升级发展历史进程。目前，振华重工明确数字化转型方向，将数字化融入公司生产运营每一个环节，促进公司转型升级，为实现“建设具有全球竞争力的科技型、管理型、质量型世界一流装备制造企业”的目标而砥砺奋进。

面对数字经济的时代浪潮，数字化转型不是制造业的“选择题”，而是制造业生存发展的“必修课”，更是制造业实现高质量发展的必由之路。路虽远行则将至，事虽难做则必成。中国制造业正搭乘数字化转型的新时代高铁，朝着高质量发展迈进。

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振华重工

2023 年 3 月，4 月
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高质量发展的“数字化之翼”

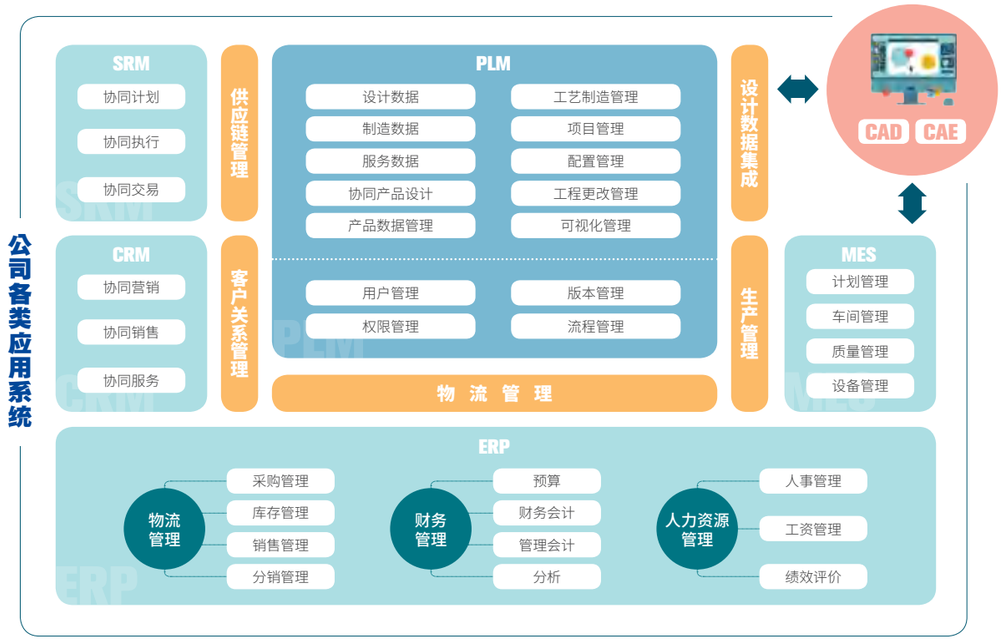
文 / 薛韦慧

当前，以互联网、大数据、云计算、人工智能为代表的新一代信息技术正在加速创新和应用，日益融入经济社会发展各领域。党的二十大报告提出，“加快发展数字经济，促进数字经济和实体经济深度融合。”面对强有力的数字化发展趋势和需求，振华重工积极落实“十四五”战略发展规划，加快构建面向数字时代的装备制造企业，以数字化赋能公司高质量发展。

“十三五”期间，振华重工制定了信息化战略规划，强化信息化顶层设计。2016 年开始推动主数据治理工作，对公司物料、往来单位、项目工号等主数据建立统一的数据管理规范标准，搭建主数据平台(MDG)。2018 年至 2019 年成功实施 ERP 一期(企业资源计划平台)项目，基本完成“搭模板、打基础”“建立业财一体化平台，强化管控”“培养一支集业务与信息管理技能于一身的符合公司未来发展要求的复合型人才队伍”等主要目标。

近年来，公司通过企业内容管理平台建设，对非结构化文件进行管理；通过 IT 服务台项目规范公司 IT 运维流程，提升运维效率；通过微信企业号集成 OA、ERP 等系统，有效实现员工移动办公应用。2020 年，公司获得了信息化和工业化融合管理体系贯标认定，标志公司两化融合管理迈上新台阶。公司还完成了 IT 服务台、ECM 等项目的云部署，形成“混合云”体系，并通过搭建混合云管平台，实现对公有云、私有云的资源纳管，使公司迈入“云时代”。

振华重装基地



构建运营管理“最强大脑”

数字化首先是管理的数字化。“数字化的一个重要作用就是在生产经营全过程通过数据集成驱动智能决策。”振华重工科学技术与数字化部总经理杨宇华说道。基于此，公司从点到面大力推进 ERP、CRM、SCM 等管理系统的建设，高效利用公司各类资源，优化再造公司内部业务流程和管理过程。

公司搭建的客户关系管理系统(CRM)，包含客户信息、客户拜访、客户商机、报价管理等功能，实现了以客户为中心的数字化营销体系，满足公司多组织多业态客户关系管理的业务需求，能够整体提升营销体系的管理能力和效率，截至 2023 年 4 月底，共跟踪项目 694 个，订单 1256 条。搭建的港机项目成本管理系统，把港机成本相关数据进行分类、分析，设计成本科目框架，形成港机成本报表，协助履约主体和项目经理及时对项目成本进行管控，有效提升项目成本管理水平。截至 2023 年 4 月底，共有 327 个港机项目纳入系统管理。

2022 年，公司圆满完成中交集团财务云业财协同项目，国内 49 个账套、海外有条件上线的 8 个账套全部启用。该项目实施推动业务与财务深度融合，加强财务为生产经营保驾护航的作用，助力公司财务管理数字化升级。

此外，在供应链管理系统(SCM)基础上，建设了公司级的供应链数据中台，不仅可以满足中交集团电子化采购率指标要求，还能实现物资从申购、计划订单、发运到入库、使用的全流程跟踪，大大提升物资查询跟踪的效率。结合数据中台，公司库存利用系统于 2022 年 4 月底上线，大幅提升利库效率，取得较好的经济效益。截至 2023 年 4 月底，共完成利库申请 6625 单。

同时，公司还开发了物资短周期询报价业务的全线上流程，优化了大件物资拆分件全过程系统管理功能，实现了全线上流程，有效提升物资采购工作效率超 20%，并提升了大件物资管理颗粒度。

打造研发生产“三头六臂”

在数字经济时代，数据成为最主要的生产要素。公司锚定数字化转型主攻方向，持续聚焦产品研发数字化，聚力推动生产制造智能化改造升级和数字化转型。

在设计研发数字化方面，公司着力推进三维设计和产品全生命周期管理(PLM)信息系统建设。2022 年完成岸桥样机设计件三维模型搭建，实现公司岸桥数字整机产品“从 0 到 1”的突破，建立了相对完整的产品数字化数据，标志着公司向产品设计端数字化转型迈出关键一步。同时，全生命周期管理信息系统也建设完成并上线，进入正式使用阶段。下一步，公司将逐步实现港机项目部件三维设计的常态化，为后端生产制造数字化提供支撑。

科技点燃转型引擎，振华重工“智造”变革已悄然发生。公司先后试点建设了 20 个自动化工作站、智能化生产线和智能制造示范车间等，基本涵盖了主要产品的关键制造流程和工序，取得一定的示范性成果。其中，振华重工长兴分公司拥有 4 条智能生产线、6 个机器人

振华重装龙门智能焊接工作站

工作站，在提质增效上效果显著。以箱梁智能生产线为例，生产线作业人员比传统车间减员 26.7%，项目制造总周期缩短约 7 天，产品良品率达 99% 以上。2022 年，车间产量由 3000 吨向 4000 吨跨越式增长，环比增长 33.3%。振华重工南通分公司建立的小车轨道焊接工作站，实现批量化、专业化、自动化制作，焊接效率提升近 100 倍，小车轨道整体制作效率提升达 6 倍以上。

除了智能化改造升级，公司在 ERP 系统、PLM 体系建设基础上逐步推进制造执行系统(MES)建设，将主营产品的设计研发数据和生产制造数据贯通，实现生产过程可视、透明、可控，搭建公司智能制造产业数字化体系。下阶段，公司还将初步构建生产运营管理体系(MOM)，致力于将设计、工艺、制造、运营管理的数据按照智能制造的数字化体系模型形成一个有机闭环。

打好运维服务“组合拳”

港口设备的全生命周期维护，不仅是码头生产运营的重要保障，也是码头管理数字化转型的重要组成部分。“公司要实现从卖产品到卖服务，打造一个新的商业模式。”杨宇华表示。

2017 年，振华重工成立子公司 Terminexus，专注港机及大型装备的备件服务。作为振华重工“一五四四”总体发展战略中倍增服务创新及后市场服务业务的实施主体，Terminexus 致力打造港机行业数字化供应链平台，开展港机数字供应链业务，利用全球港机存量市场的数据优势，整合与优化供应链体系，帮助码头客户降本增效，逐步扩大港口设备后市场业务市场份额。目前，Terminexus 港机数字化供应链业务已与全球 326 个港口码头企业开展合作，助力港口码头企业对大型装备资产管理能力和效率的提升，助推振华重工一站式服务质效提档升级。

Terminexus 通过工业品集成服务(MRO)模式实现数据的有效管理及利用。同时，积极搭建港口装备 SBOM 体系，利用数字化技术，整合整机设计资料、码头客户实际消耗数据、供应商产品设计数据，与用户一起共同优化备件库存管理和采购策略，降低维护成本和停机时间。

Terminexus 还专注提高数据储存与管理服务水平。通过建立“数据仓库”，将备件数据、合同订单等海量数据“搬”至线上，实现数字化的“第一步”。通过升级建设“数据湖”，将数据库数据、系统运行日志数据、文本图片类数据等结构化、半结构化、非结构化数据集中存储。“数据仓库”和“数据湖”的建设实现了根据客户提供的图纸迅速查找整机型号，并了解用户之间的需求差异以提供定制服务。

此外，Terminexus 正致力于搭建一体化服务保障平台，整合产业链上下游，链接全球合作伙伴的数据，为码头装备使用方提供更专业、更高效、更便捷的一站式服务，进一步提升与用户的黏连度，为振华重工的产业链贡献新的价值。

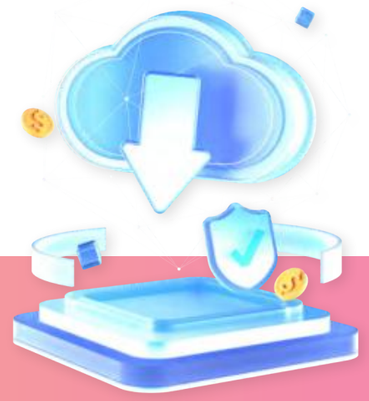
未来，振华重工将持续推进运维服务数字化，通过对 ERP 系统、PLM 系统、MES 系统的主线建设，再连接上下游的 CRM、SCM 等重要系统，同时运用数据中台的能力，整合内部生产管理数据和外部产品售后、运维数据，从而形成一个具有行业特色的工业互联网平台，为一体化服务体系提供技术支撑。

向“高”攀登，向“数”前行。振华重工积极抢抓数字技术带来的机遇，贯彻中交集团“123456”数字化转型总体蓝图，力争建设以港机装备“研产供销服”为核心的数字化生态链，为大型装备制造业的数字化转型输送动力，让数字化成为公司高质量发展的新引擎。

（供图 / 各单位）


振华重工长兴基地

“财”发现你是这样的“云”



文 / 薛韦慧

“终于顺利上线了！”2022 年 9 月 1 日，振华重工财务云业财协同项目工作小组总体协调人王丹斌松了口气。对他和团队伙伴来说，半年的辛苦、努力都在这一刻得到了回报。

财务云业财协同是中交集团“十四五”数字化转型重点任务，也是建设全球一流“智慧运营”体系的头号数字化工程。“与其他板块相比，财务具有相对统一的标准体系，而且关联性强，它能够倒逼业务，夯实流程、标准、制度三大基础，实现数字化变革。”工作小组组长、科学技术与数字化部总经理杨宇华介绍道，“这不是简简单单的财务上‘云’”。财务云业财协同是一个“两步走”工程，第一步是财务云上线，把现在使用的本地浪潮客户端“搬家”到云端，实现财务管理云端化、数字化、智慧化。第二步是在项目实施过程中实现业务与财务的深度融合，改变现在审批、付款各走各流程的现状，提高公司管理效率。

财务云业财协同项目工作小组集中办公

作为中交集团财务云业财协同 2022 年“930 节点”上线单位，振华重工高度重视，积极做好总体安排、策划、部署。由科数部、财务部牵头，联动相关部门、二级单位，火速成立 100 多人的项目团队，分成系统集成、数据治理、财务云业务、基础架构四个专项小组，围绕系统集成、数据标准化、数据清洗和财务云替换四大块核心工作，细化目标任务，倒排项目工期。

“相对于其他兄弟单位，振华在系统集成方面是有基础的。”执行组长赵子健说。公司此前已经建设有 SAP ERP、MDG、ECM 等核心应用系统，技术方面的工作主要是和中交的统建系统对接，调整公司原有系统、功能点，开发接口。项目建设期间共完成公司内部 5 个业务系统 75 个功能点改造，114 个接口开发。“这里有个创新点，我们建设了一个数据中台，既提供了数据治理的用户界面，也能通过这个统一的中台最大限度降低业务系统改造的难度和风险，实现和中交统建系统的统一对接。”

“数据标准化是打通业财协同的关键纽带。”日常分管数据治理的副组长王苹介绍说。公司以往使用的业务系统各有标准，不同系统之间的数据无法进行联通。财务云业财协同通过建立财务数据的标准化，对公司整个业务系统中的数据进行梳理。“数据标准化并不是一蹴而就的，集团的财务标准一直在调整，每次调整完，我们也要重新组织各方调整。”

随着财务数据标准的最终确定，数据清洗工作正式启动。数据清洗涉及到项目、合同、往来单位三部分，工作量大，种类繁多，需要配合的部门、单位也多。为了顺利开展数据清洗工作，公司组织主数据治理方案专项讨论会 6 次，业务标准培训 10 余次，累积 300 多人次参加。“虽然已经做好心理准备，真正开始清洗的工作量还是让所有人吃了一惊。”主要负责组织数据清洗的何德喜说道。譬如，要把所有合同数据按标准去整理，即合同和哪个单位签的、什么时候签的、往来单位是不是规范、合同经办人是谁……把一份合同清洗完善成几十个这样的字段。公司 2 万多份合同数据这样去清洗，其工作量可想而知。“数据清洗工作对于全公司来说都是很难的一件事。”参与数据清洗的赵越补充说道，“很多以前的纸质合同保存不完整，一些久远的合同甚至收了多少钱只有当时的经办人知道，这时候就要合同经办部门或者单位去‘考古’，找相关记录。”

经过 90 多天的奋战，公司各部门、二级单位近 500 人参与数据清洗工作，共计完成 2.29 万份合同、2.18 万个往来单位、2.2 万余项项目的数据清洗。

最后，在前三大块工作的基础上，把浪潮替换成云端的财务云。替换过程中涉及到大量数据的转换和功能的重新调整，不仅工作体量特别大，而且还经常受到加载网速的影响。“替换中总会出现各种各样的小问题，对于财务部来讲这可能是他们去年最艰难的工作了。”王丹斌说。

项目建设期间，为打破信息壁垒，实现横向协同，项目团队自 2022 年 7 月份开始在总部的一个会议室集中办公。很多人在不断沟通的状态下，每天高强度工作 10 多个小时，“而且参与财务云建设的大部分同事都是在本职工作基础上兼职的，半年时间里，大家都非常辛苦。”王丹斌表示。

历时半年攻坚克难，公司财务云终于在 2022 年 9 月 1 日上线，比原计划提前一个月。未来，公司将继续严格落实中交集团财务云业财协同项目组要求，确保财务云数据和业务的高质量运行，同时借助“一朵云、一个平台、一本账、一套表”，推动管理穿透，促进公司数字化转型升级和高质量发展。

（供图 / 王丹斌 陆志东）

迈好设计“数字化转型”第一步

文/洪　豆

“万事开头难啊！只有走好设计端三维数字化的第一步，接下来的转型之路才会更加顺畅。”回顾岸桥三维数字化样机这六个月以来的搭建历程，振华研究设计总院机械院副院长尹刚感慨万分。

历时六个月，包含 9000 多个部件，振华重工的岸桥典型产品样机完成了三维数字化建模工作。作为港机产品数字化项目一期的核心任务，岸桥三维数字化样机的搭建涉及设计三维化与全面数字化转型，成功实现将二维 CAD 图纸转换至附带关键信息属性的三维模型，大大提升了工作效率。该项目标志着振华重工产品设计端的数字化转型迈出关键一步，实现了公司岸桥产品数字化从 0 到 1 的突破。

艰难困苦，玉汝于成，岸桥产品三维模型搭建并非一帆风顺。如何在短短半年时间内摸索出一整套完整的流程体系，是摆在项目团队面前的一道难题。

“怎么打通数字化的系统流程？怎么保证数据的一致性和唯一性？我们只能边做边摸索，免不了要交学费和走弯路。”初次搭建岸桥三维数字化样机，对于团队来说就是“摸着石头过河”，起步阶段纠错返工都是常有的事，“前面做得越快，后面返得越多。”

面对接踵而来的种种难题，团队成员没有退缩，坚持在“试错”中积累三维建模经验，在实践中打通数字化体系化流程。一方面加班加点，在平常的设计工作之余挤出更多休息时间，合力推进三维建模工作。另一方面勤于记录，把过程中遇到的各项问题、困难和解决方法记录下来，填补初期框架，形成完整的指导手册，在反复克服种种困难的过程中致力走好港机产品三维数字化第一步。

既要“争分夺秒保数量”，也要“规范标准保质量”，虽然周期紧张，团队始终严格保证各零部件三维模型的标准规范。“岸桥产品是我们的拳头产品，把它做成标杆，就是要让后面的项目都可以参照它的标准。”作为项目负责人，尹刚十分清楚踏实走稳第一步的重要性，在样机搭建过程中带领团队以高标准严要求攻克众多难点，扎实筑牢了港机产品标准化的规范准则。

谈及产品标准化与三维数字化之间的关系，尹刚认为二者之间相互促进、相辅相成，是共同推动公司数字化转型与高质量发展的必经之路。“标准化的程度越高，三维数字化的难度就越低；同时，三维数字化程度越深，标准化的后续推进也越容易。”事实上，团队在样机搭建初期就曾因为缺乏全面系统的规范标准导致各零部件三维数字模型之间出现尺寸不合、装配关系错误等问题，阻碍了三维数字化进程。正是后续统一规范标准的建立，令岸桥产品形成了相对完整的数据，也为之后场桥产品的标准化积累了系统性的流程经验。

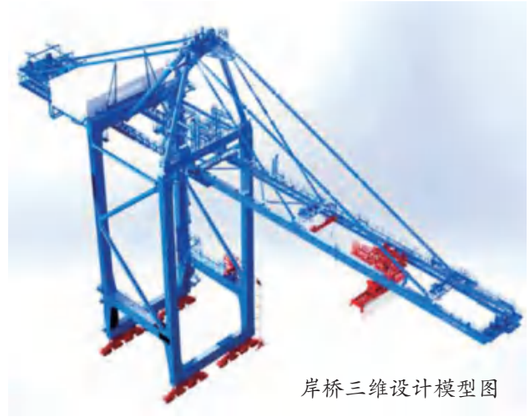
标杆在前，以点带面。如今，样机的成功搭建标志着设计端三维数字转型迈出第一步；而如何全面推广和应用三维技术，将是化点为面、积蓄转型规模化力量的关键一步。“一是要有数字化的理念，二是要做好顶层设计。”振华设计研究总院党委书记吴富生说道。

如何加快设计人员的观念转变？关键在于三维设计系统的优化提升。目前设计端使用的三维设计软件还存在一定操作门槛，许多设计人员在工作中难免出现不适应、难操作等问题，仍旧倾向于使用传统的二维 CAD 图纸工具。因此，项目团队下一步将改进现有的三维设计工具，简化操作流程，提高设计工效，做好港机产品三维设计深度规模化的前期技术积累。

除此之外，团队还将从全局出发，把“信息孤岛”连成“数字群岛”。如今设计端已经实现“从 0 到 1”的新突破，“接下来更要去做好设计、工艺与生产三个阶段之间的数字化接口，形成从设计端到生产端的全流程数字化。”吴富生补充道。

数字化转型大势所趋，振华重工必将迎头赶上。“我们正在经历爬坡的过程，以设计端三维数字化为起点，借助信息化的新技术提升竞争力。”振华研究设计总院院长李义明表示，“今年是中交集团‘高质量发展深化年’，我们相信，未来的振华重工必将以数字化转型赋能高质量发展，以高质量发展塑造新优势！”

（供图 / 肖慧灵）



岸桥三维设计模型图

深藏不露的“数据湖”

文 / 薛韦慧 赵欣颖

“我们要采购一台减速箱，很着急，能不能快速供货？”这是 2020 年 2 月，马士基摩洛哥某码头负责人打给 Terminexus 的一通电话。码头负责人表示一台岸桥停机，检查后发现是减速箱出现了故障，需要更换。

传统模式下，码头装备更换备件采用“查询现场库存 - 采购新配件”的流程，遇到紧急状况时，只能停机等待配件，新减速箱交货周期正常要 4–5 个月。期间，岸桥“趴窝”影响码头正常运行，会造成一定的经济损失。因此，码头负责人焦急万分，希望 Terminexus 能尽量缩短供货流程。

一周后，Terminexus 给出惊喜回复，“某码头仓库里有同型号减速箱，处于闲置状态，你们可以内部快速调运至摩洛哥。”

为什么 Terminexus 能知道全球各地仓库的库存，甚至连产品的型号都知道？这背后的秘密功臣正是“大数据”。

以往，码头备件市场供应商、渠道商鱼目混珠，备件质量良莠不齐，且信息分散、协同性差，无法满足码头的及时需求。对此，Terminexus 一直尝试运用数字化手段来解决这个行业痛点。

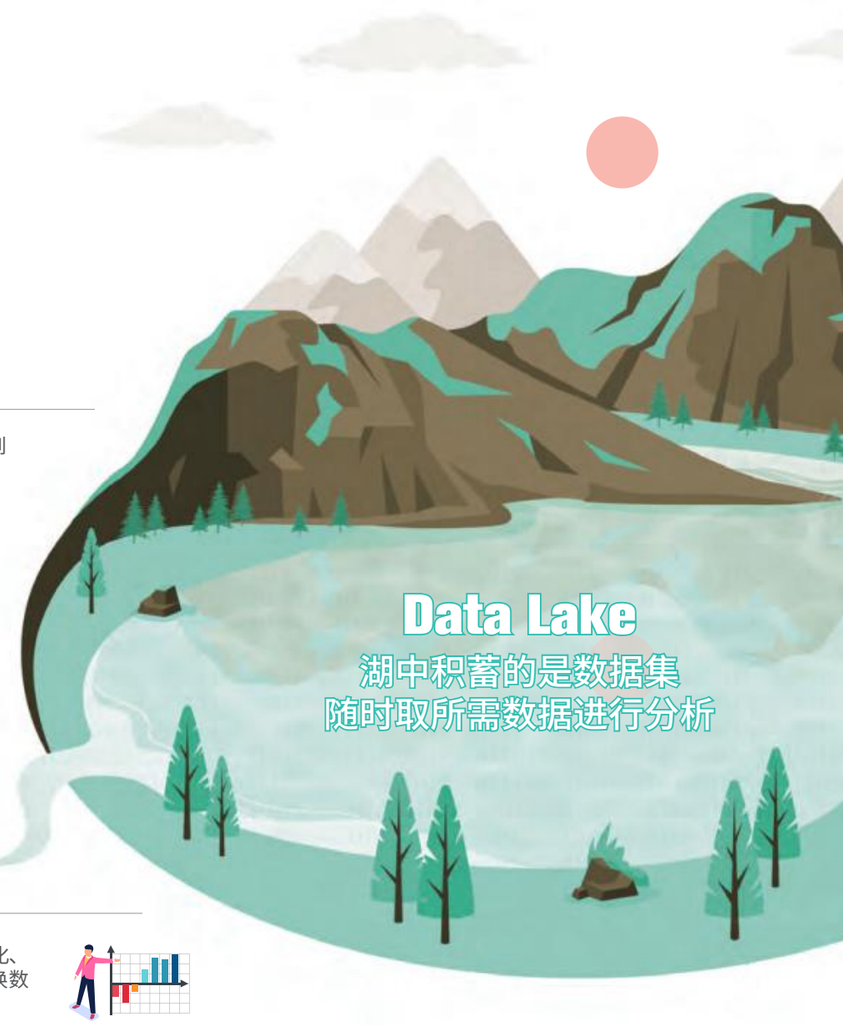
2020 年，Terminexus 建立“数据仓库”，将海量数据“搬”至线上，实现数字化的“第一步”。2022 年，在“数据仓库”的基础上升级建成“数据湖”，进一步提升 Terminexus 数字化建设水平。

“数据湖”是一个以原始格式存储数据的系统，通过它可以为用户提供更精准的服务。Terminexus 信息科技部经理吴梦介绍说，“这个‘湖’可以存储港机及大型装备项目的设计图纸数据、合同数据、业务流程数据等，且不断更新。而且，收集的是原始数据，不经过处理，没有损耗，能保留更多的细节信息。”针对产品设计图纸，“数据湖”甚至可以精确记录到产品的零部件信息。当用户有配件需求，就可以立即从‘湖’里检索出对应的产品型号、备件库存等信息。在过去，这需要花费一到两天，有时甚至长达一周。

如今，“数据湖”已经接入与振华重工业务订单相关联的 5 千多张图纸数据，涉及项目遍及世界各地，如美国的长滩港、加拿大温哥华港，国内的上海港、广州南沙港等。在“数据湖”的助力下，用户的多起紧急服务需求都在极短周期内得到解决，备受用户认可。

然而，“湖”中仍有巨大潜力。Terminexus 一方面不断增加振华重工内部数据，除了目前的产品图纸数据，下一步还将把订单单据放进“湖”里，通过单据数据分析物流、关税等情况，反向优化业务流程。另一方面积极向外“挖掘”，增加用户及供应商数据。Terminexus 市场开发部经理曹永平表示，“随着‘湖’里数据越来越多，可以迅速匹配振华重工、用户及供应商库存中的现货资源。”

广州南沙四期全自动化码头一体化服务保障平台正式运作



此外，“数据湖”的源头数据也不再局限于业务订单数据，Terminexus 尝试通过在用户码头安装传感器获得码头设备运行的监测数据。这样，港口设备的全生命周期维护就能实现从故障后的维修延伸到故障前的维护保养，进一步降低用户设备运营成本。

Terminexus 构建“数据湖”旨在整合振华重工、用户、供应商及各港口资源，实现对用户服务请求的快速、精准响应，为用户提供更高效便捷的一站式服务。这样，用户就不必自行承担备件仓储成本及更换所需的时间成本。同时，基于“数据湖”作出的分析，还能帮助 Terminexus 作出更准确的备件采购决策，在保证全产业链服务质量的同时精准备货、盘活库存。

当“数据湖”积蓄越来越“深”，Terminexus 就可以实现“低库存、低成本、快交付、高效率、高质量”为用户提供全产业链一体化服务，确保用户与振华重工在港机全生命周期内的紧密合作。曹永平自信地说：“通过提供优质服务，可以给用户带来实惠，让供应商提升管理效率，最后带动整个产业链的协同升级，这是振华重工数字化运维服务的长远目标。”

（供图 / 曹永平）

流机市场向好，企业如何抢占先“机”？

文 / 刘冬一

港口流动机械设备（以下简称“流机设备”），是指以跨运车、AGV、无人集卡、正面吊 / 堆高机等产品为代表的小港机，作为码头作业工艺中水平运输的重要一环，广泛用于港口、码头、铁路公路中转站，以及堆场内集装箱的堆垛和转运。

振华重工深耕流机市场多年，目前流机产品主要有跨运车、正面吊，产品已远销非洲、亚洲、欧洲、美洲等十余个国家和地区；AGV、IGV 等智能化搬运设备也已广泛应用于国内外多个自动化码头。

流机设备的行业前景和目前国内外的市场环境如何?

流机设备市场前景广阔。在 AGV 市场方面,近 5 年的市场规模增幅已达 30% 以上,预计未来 5 年内这一趋势将继续扩大。就目前掌握的资料来说,国内仅 2024–2027 年预计可新增 AGV 近 700 台,产值约为 25 亿元。

在跨运车市场方面,国外市场多年来已形成成熟稳定的增长状态,2021 年全球市场保有量达到 12193 台,有利于市场的提前规划和预投产模式实施。而国内港口使用跨运车的案例完全是空白,市场尚有很大潜力可以挖掘。自 2017 年至今,全球跨运车市场需求逐年递增,年均增长 4.5%,年均增长产值约 25 亿元。

从国际市场来看,欧洲是跨运车和 AGV 等港口流机产品的发源地和流行地。目前,欧洲港口使用最多的是跨运车,其次是 AGV。除了吞吐量在全球排名前列的荷兰鹿特丹港、美国洛杉矶长滩港、德国汉堡港以外,欧美的大部分港口主要以中小规模的形态呈现,但数量极多,因此也造就跨运车和集卡在欧美市场占比更高的结果。为了推动港口智能化、无人化的进程,位于“海上丝绸之路”沿线的汉堡港、鹿特丹港、阿布扎比港等多个港口已开始无人驾驶集卡的测试工作。与此同时,马士基、和记黄埔等航运巨头同样在关注和践行无人驾驶跨运车的尝试。而在亚太地区,长期占据全球吞吐量前列的新加坡港、韩国釜山港等,则主要朝着 AGV、无人驾驶集卡的方向推进港口自动化的发展,其规模巨大的特点更适合 AGV 和无人集卡产品集群优势的发挥。

从国内市场来看,沿海港口规划、建设和运营状况良好,总体上呈健康平稳、持续发展态势。在旺盛的运输需求带动下,货物吞吐量特别是外贸集装箱吞吐量持续快速增长,港口建设步伐明显加快,港口呈现出规模化、集约化、现代化、自动化发展趋势。据交通运输部数据显示,我国目前已建成 10 座自动化集装箱码头,并有 7 座自动化码头在建,已建和在建规模均居世界首位。其中,多个智慧码头实现亚洲乃至全球首创,新建和改造码头需要投入港口设备,而负责水平运输的流动机械是实现码头高效作业的关键所在。这一波自动化码头的建设浪潮,由振华重工主导和深度参与,积累了宝贵的建设经验,在国内市场,已经占据头部位置,成为行业的国内领军者。

振华重工为瑞典研制的 2 台智能跨运车

面对新形势,企业如何找准流机业务发力点?

首先是提升新型设备创新研发能力。基于港口设备设计基础,企业要针对不同码头的实际情况,结合装卸工艺系统设计要求,在原有机型上做出新的创新设计。例如适用于不同装卸和运输需求的不同高度跨运车系列,应用于水平运输为主或兼顾水平运输和堆存的各类码头。例如针对旧码头升级改造的 8 轮 4 轴 IGV 机型,通过创新的底盘设计,降低车辆高度和对地轮压,使其能够满足旧码头的土建设备,配以无人驾驶为主的导航系统,为水平运输自动化升级市场的需求提供适合的方案。这些针对不同用户的个性化定制需求,一方面能体现出研发团队的强大实力,另一方面,通过优良的品质和周到的服务,也能让用户提升体验感和忠诚度。

其次是提升产品的智能融合能力。企业要利用 AI 加持的多种流机设备,研发适应多种应用场景的系统解决方案,适用于不同的自动化码头工艺路线,并将应用场景拓宽到如机场、火车站等物流集散地的设备市场,有效提升货物转运效率,降低运营成本。

再次是提升产品绿色发展(减碳)能力。近年来,绿色低碳成为港口建设的重点工作,绿色港口建设是未来港口发展的必然趋势。企业的全系流机产品,要从码头用户实际出发,细分动力配置,与自动化码头节能环保零排放相匹配。产品设计包含全电驱动、氢能驱动、柴电混动、气电混动、高阶纯柴等全系列动力配置,践行绿色发展理念,满足不同码头用户的各种能源需求。

振华重工流机技术团队在研发新能源动力系统的过程中,以降低能源损耗为导向,逐步掌握多重新能源动力系统的设计和应用技术,积累混合动力系统、全锂电系统的多个项目应用,并为不同的装卸工艺需要开发了多种能源补充技术,例如机会充电、整体换电、大功率快速充电、天然气混合动力等,并已在无线充电、氢燃料电池领域实现了新的突破。

最后,是提升产品标准化设计能力。相比于岸桥等大型港机产品,流机产品体积较小、集成度高,在产品研发全过程中,一方面要能够满足不同场景的个性需求,另一方面也要持续提升产品在设计、装配等环节的标准化工作,提高设计的精准性以及装配的高效性。产品设计的系列化、标准化和模块化,将会带来更低的成本,以及更快的交货速度。通过对集装箱码头、堆场或者物流园区装卸工艺分析设计,进行产品设计和关键技术研发,满足不同作业场景的工艺要求。其中,要将重点放在关键机构、动力系统和软件系统的设计,利用关键配套件和技术的组合,形成各个应用领域的标准化、系列化机型供应。

(供图 / 陆志东 丁小峰)

工程师在车间进行技术指导

盾构主驱的传动创“芯”

文 / **保建军**

“这个‘振兴号’就是采用振华研制的主驱减速箱！”今年 3 月初，振华传动设计研发部钱瑞指着手机上央广网发布的《仅两个月车流量突破 400 万辆》新闻说，南京和燕路过江通道施工中采用的刀盘直径 15.03 米的“振兴号”盾构机，其主驱减速箱来自 ZPMC。在超大直径盾构主驱领域，振华重工遥遥领先。

几天后，又一批 14 台盾构主驱减速箱排队登车发运，这 14 台双速比盾构主驱减速箱实现了“自动档”升级。振华传动于 2022 年 12 月成功研制出世界首创的该类型产品，让其成为领跑市场的佼佼者。

盾构主驱减速箱是盾构作业中的核心部件，它为盾构刀盘“钻削”地下岩石和软土提供强大的扭矩，“啃不啃得动，牙床硬是关键，主驱减速箱有几份牙床的意思”。

近几年，直径 15 米以上的超大直径盾构中，北京东六环改造工程东线隧道“运河号”16.07 米盾构机、珠海兴业快线主线项目直径 15.76 米“兴业号”盾构机、江阴靖江过江通道左线隧道项目直径 16.09 米“聚力一号”盾构机等，都采用了 ZPMC 的盾构主驱减速箱。

今年春节前夕，振华传动顺利中标客户超亿元大单，这也是国内迄今为止签下的最大的盾构机减速箱订单。2023 年注定又是一个“撸起袖子加油干”的关键年，“盾构主驱减速箱市场占有率突破 50%！”钱瑞攥了攥拳头，30 多个项目的设计任务正加紧完成。

“每天可以完成一到两个项目，现在设计轻松，生产高效！”钱瑞坦言，振华传动的盾构主驱减速箱研发中，应用了模块化设计理念，让设计和制造变成了“搭积木”。“8 年多时间里，振华传动完成了 360 多个项目，覆盖 36 种速比、20 多种功率的盾构主驱减速箱，其行星部件部分完全实现了模块化，轴承型号一共只有 10 多种，油封型号只有 3、4 种！”

8 年奋进，ZPMC 盾构主驱减速箱已实现从国产替代——跟跑国外产品，向模块化研制——与国外产品并跑，到首创“双速比”自动档——领跑的华丽转身。

2016 年，面对陌生的市场，振华传动组建研发团队，对接主机厂家从目标参数、输出要求入手，研究速比、结构、材料、加工方案。研发的第一代产品以仿制为主，采用了单悬臂构造。2 台 90 千瓦的主驱试制出来后，为确保性能，在自制的加载试验台上，进行了连续 1 万多小时运转的耐久测试。当年 8 月，产品顺利通过江苏省机械行业协会组织的盾构主驱减速箱产品鉴定，获得了市场准入资格。

“现在回想起来，那个时期我们的产品只能算国产简单替代。”钱瑞指出，“盾构主驱减速箱有一项指标，叫作扭矩密度，国外产品大概每公斤 125 牛米左右，产品性能还停留在 20 年前。我们经过优化的产品能达到每公斤 160 至 170 牛米。”

为提升产品性能，在全新设计的 ZPMC 盾构主驱减速箱上，研究采用多达 9 项新技术，包含轴承、油封结构和材料的创新，以及产品散热方式创新等。“简单说，新设计的产品结构更紧凑，自身体积和重量大幅降低，输出的扭矩更大。”

新技术的应用，还离不开制造工艺的不断创新，制造精度和制造效率的不断提升。模块化也让制造效率、质量都提升明显。“面对超短周期订单时，我们可以从容不迫，零件互相借用。维保方面也十分便捷！”振华传动市场部经理谢济明认为，这种设计和制造理念值得在新产品研制上大力推广。

2022 年底，新研制的双速比主驱盾构减速箱将两套减速系统组合在一起，让盾构在地下软层土壤和硬岩施工中，可以自动切换，既提升硬岩地层施工的速度，又在遇到软土地层不明硬物“卡机”时能实现轻松脱困。

回想起 2016 年夏天在郑州地铁 3 号线施工隧道中，盾构刀盘被凝住的那段遭遇，钱瑞说：“要是用现在的这个双速比主驱盾构减速箱，应该完全‘锁不住’，双速比的自动切换会提供高达 2.2 至 2.5 倍的扭矩，自动粉碎混凝土‘绊脚石’不在话下。”

“创新不是一个节点，它是振华传动始终坚持的方向，无论是产品研发、产品更新换代，还是制造工艺和手段方面，都是推动高质量发展的引擎！”振华传动总经理戴立新表示。

（供图 / 保建军）

密配套件厂家专业技术人员就密封圈安装进行现场交流指导

振华传动研制的首批双速比“主动档”盾构主驱减速箱

码头装卸家族的“新成员”

文 / **陆怡艳**

阳春三月，生机盎然。广州南沙四期码头现场空无一人，却呈现出一派繁忙工作景象。在码头最右侧区域，原先空无一物的岸边如今摆放着5台门机，多台无人驾驶智能引导车（IGV）正在门机的臂架下井然有序来回穿梭，1分半钟不到就可以完成单个集装箱的装（卸），整个过程行云流水。

广州南沙四期现场，多台 IGV 正在进行集装箱装卸工作

“这是我们最新投入使用的门机对 IGV 装卸工艺。区别于码头上其他的岸桥、轨道吊对 IGV 的全自动化装卸工艺，这个涉及到‘人机交互’，情况更为复杂。由于是全球首创，该工艺在项目设计、研发的过程中完全没有可借鉴的经验，这对我们设计研发团队来说是一个巨大的挑战。”南沙四期码头项目部成员代强介绍道。

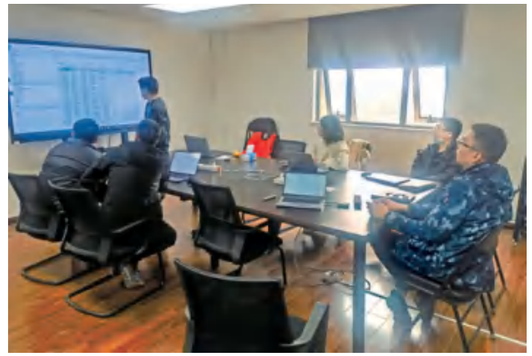
在南沙四期码头规划之初，用户就将码头最右侧区域划定为驳船装卸作业区，驳船体积小，搭配门机作业更加灵活高效。然而不同于其他区域的全自动化装卸，此区域的 5 台门机是人工操作，这就要求背后的调度系统更加智能。项目团队需要在原有的交互逻辑基础上，进行相应的定制化修改和开发，来保证人工操作的门机有一定自由度的同时，不影响码头整体的自动化运行。

如何让调度系统这个“智慧大脑”更聪明是一个漫长的过程，其无法判断常规作业之外的操作，是项目团队需要攻克的主要难点之一。“由于门机是人工操作，动作不像自动化岸桥那样固定，会有很大的随意性和不确定性，这使得调度系统依据抓放动作的位置来判断任务完成情况的逻辑变得非常复杂。”系统分析师宁文阳介绍道，“当时我们想引入一种特殊模式，待司机完成操作后自己确认任务完成，这就相当于切换到了‘人工模式’，这样就弱化了系统判断。”

但是考虑到系统整体的智能化运行，项目团队内部又进行了多次会议讨论，最终还是推翻了这个方案，决定通过设计和逻辑上的优化来解决这个问题，软件开发团队为此也付出了巨大的努力。

项目临近投产前的某天，宁文阳刚上班就接到了南沙四期现场测试团队成员程龙的电话：“宁工，用户反馈说我们的 IGV 要等到门机将抓取的集装箱放上船后才会离开，这样太不高效了，你看看我们是否可以尽快优化下这一点？”电话挂断后，宁文阳立即组织召开会议，与开发和测试人员一同讨论。

“我们可以将装船任务中允许 IGV 驶离的时间节点提前至抓箱到安全高度，这样 IGV 能够提前释放运力，缩短任务执行间隔时长，这需要调度系统和 PCMS（门机管理系统）之间的交互流程做一些调整。”宁文阳开门见山地表示。



项目设计研发团队在会上根据用户要求讨论解决方案

“可以将交互提前到抓起到安全高度时给‘完成’信号，调度系统结合该信号进行综合判断，为 IGV 规划后续任务离开。”“但门机任务状态要保持到装船动作实际结束，任务信息系统内仍然需要根据司机的放箱位置做处理，来保证我们任务信息的准确性。”调度开发工程师濮仪和 PCMS 开发工程师唐志绰分别表达了自己的看法。

“另外，即便调度层面允许 IGV 离开，但实际区域锁定能否解除还是要依据 TOS 对于理货结果的判断。我来和 TOS 负责人沟通一下我们这部分流程的变更，以便他们能够及时做出调整。”会上，大家展开头脑风暴，不多久就敲定了方案。

一周后，新的迭代版本发布，码头现场马上进行了测试，新系统成功解决了 IGV 等待的问题，能实现门机将集装箱吊至安全高度后，IGV 即可被释放，离开进行下一项作业。

此次全球首创门机对 IGV 装卸工艺的顺利投产，不仅助力了广州南沙四期码头高效运行，也为未来传统中小码头进行自动化升级改造提供了解决方案和参考借鉴。

（供图 / 代强 谢星）

港机领域的“铿锵玫瑰”

文 / **李天意**

1995 年，23 岁的富茂华大学毕业后进入振华重工。在这里，她找到了值得为之奋斗的事业。从业 28 年，从静心绘图到主持项目，从设计研发到技术管理，从单枪匹马到带领团队打硬仗，她主持设计过 40 余台岸桥，与用户共同合作过 3E 岸桥设计，统筹参与过洋山港等多个自动化码头项目。如今，她是振华重工副总工程师、振华设计研究总院机械设计院院长，在平凡岗位上演绎着精彩人生，成为一朵在港机领域傲然绽放的“铿锵玫瑰”。

走进办公室，窗台上的蝴蝶兰绚丽绽放。书柜里，印有“起重机械”字样的大部头书籍摆放得整整齐齐，富茂华取出了一本封面泛黄、书脊处还有透明胶修补的“藏书”——《起重机械金属结构》。“我搬了好几次办公室，这本大学时代的教科书陪了我好多年，有时我也会翻一翻它。一直坚持做一件事，心里会觉得踏实。”留着一头干练的齐肩短发，脸上挂着梨涡的富茂华笑着说。

“一路走来，我经历过很多微小却意义重大的时刻。”回顾这 28 年，富茂华先想起的是前辈们对自己的教诲。那时，设计图纸有变更需要填写修改单，并且全部是手写。有一次，富茂华的修改单描述有问题，字也写得潦草，被当时的公司技术部经理严云福退回来两遍。另一位工程师前辈，时任陆工院副院长的张明海，则让她领悟到“创新”的含义。张明海常常引导她：“我们能不能换个新的方式去解决问题？”那个时候，创新的种子已悄然在富茂华的心底生根发芽了。

前辈们的言传身教，富茂华始终铭记于心，做到了一丝不苟精益求精。2011 年 2 月 1 日，还有 2 天就是辛卯年春节，但富茂华的头脑里没有节日的概念，她心心念念的，是刚刚与上海外高桥明东码头谈好的合同。“这是首台节能型岸桥的研发项目！周期仅短短 10 个月，节能考核要求高达 10% 以上，更缺人手。”她埋头伏案，独自推出每个部件的总图布置和项目的总体方案，节后一周，已经组织技术团队与用户进行方案论证了。

春节就这样在学术的气氛中度过了。

不久后，公司将马士基这一大客户交到了富茂华的手里。说到马士基，大家都不陌生。它是全球最大的航运及码头管理公司，采用全球招标、集中采购的模式来添置大型港机设备。富茂华受命担任马士基大客户经理，对口技术负责人，需要全面更新马士基与公司的框架协议。

由于马士基客户对于标准的要求甚高，这份协议将标准项和选择项的规格细节全部列入，每两个月更新一次。两年间，富茂华“啃”下了一部又一部的英文标准，无数次赴荷兰海牙进行技术谈判，“我们逐条地过，抠文字抠细节。”修改 13 版后，最终形成 170 页的《标准技术规格书》《基于 ISO 规范的危险分析报告》等一系列标准性技术文件，简化了公司与马士基后续合作新项目时的技术谈判和实施流程，这些文件至今仍在使用。

如今，富茂华已成为中国工程机械学会港口机械分会副理事长，成为获得中国港口科技进步奖一等奖、上海市科技进步奖二等奖、上海市三八红旗手、中国交建创新英才奖等诸多荣誉的技术大咖。同时，她还拥有 5 项专利，著有《双起升岸边集装箱起重机技术在自动化码头的应用》等 3 篇论文，参与撰写《智慧绿色集装箱码头》等 2 本著作。

时光荏苒，日月如梭。富茂华在“岸桥海洋”里乘风破浪，“只干一件事，难度不是那么大。”富茂华一手支颐，眼睛看着前方，“我一直认为，生活与科研的美好在于简单、安静与坚持。”

（供图 / 富茂华）

富茂华在德国汉堡 CTA 码头

富茂华与同事们讨论图纸问题

富茂华在“码头智能化解决方案交流论坛”上作主题演讲

让幸福“一梯直达”

文 / 李天意

“小唐，你停这边！”4 月 10 日上午，振华重工新产业事业部经营人员唐莉琴驱车驶入徐家汇漕溪四村兆嘉园小区，迎面而来的是一幢幢砖红色的楼栋。只见两鬓斑白、高高壮壮的吴叔叔和楼组长汤阿姨在楼下热情地挥着手，刚刚停好车的唐莉琴拿好文件，急忙开始沟通本单元加梯的进展。这一幕在过去一年半的时间里不知道上演了多少次，但不同于往常的是，这里即将迎来振华重工徐汇区首单加装电梯开工仪式。开工看似简单，但背后是居民和振华重工两年多的坚持与付出。

一直以来，老房加梯是居民们的心之所盼。徐汇区漕溪四村兆嘉园 50 号早已有安装电梯的“小目标”，但二楼的步道却成为了圆梦路上的“拦路虎”。很多专业加梯公司提出，如果要保留步道，就必须拆除北侧部分小花园。小花园可是居民们日常锻炼身体的好去处，一听说要拆除花园才能加装电梯，居民们都泄了气。既想保留步道和花园，又想安装加梯，“悬空老人”还有“接地气”的希望吗？

曾在上海港机厂工作的吴叔叔对振华有着很深的感情。一听说振华有加梯业务，立刻主动与振华联系沟通，并将加梯重新提上日程。为此，他特地赶来浦东考察振华已建成的加梯，还给公司领导写信，迫切希望“振华加梯”入住兆嘉园。公司领导们聆听到了吴叔叔等小区居民的心声，第一时间派唐莉琴与业主代表吴叔叔取得联系。唐莉琴联合公司项目团队在小区反复勘察后，制定了初步加梯方案：“吴叔叔，我们把二楼步道靠近 04、05 室这侧敲掉一部分，保留小花园，您和楼内居民沟通下，看看是否可以接受？如果还有什么疑问，您可以随时联系我！”从此之后，唐莉琴三天两头地跑现场，手机里满满一屏幕都是吴叔叔、楼组长汤阿姨的通话记录。

2022 年 2 月，上海市政府副秘书长、区委副书记、区长杭迎伟来到潍坊九村，乘坐了振华重工加装的电梯

“加梯质量怎么样啊？这可是和生命安全挂钩的！”居民提出了疑问。经初步判断，施工队需要在现场搭设脚手架，尽量采用分段钢结构吊装。“振华主业就是和钢结构打交道的，对于加装电梯选用的主体工程钢结构质量严格把控。”振华重工的钢结构工程师解释道。

“我代表漕溪四村 50 号居民们谢谢你们！辛苦了！”提及这次顺利开工，吴叔叔激动地说：“我一直在和小唐联系，她对施工和办理各项手续都很严谨，必须按照市里的规定。员工这么负责，那企业也一定是有责任、有爱心的企业！”吴叔叔对着唐莉琴竖起了大拇指。汤阿姨也大力支持，“你们信誉度高，而且是大国企，我们也放心质量！”

在唐莉琴看来，从事加梯业务后，除了业务能力有所提升，她还收获了很多“忘年交”。在她手机里收到的一个视频中，三位年过花甲的阿姨依次从浦东新区临沂六村的加装电梯里走出来，神采飞扬，脸上洋溢着喜悦。视频中间“一键直达，幸福到家”的字幕持续闪烁。“阿姨们昨天还给我分享了她们种花的照片。”唐莉琴笑着说道。潍坊新村的叔叔阿姨们也切实感受到了加梯带来的便利。在没有加梯之前，由于上了年纪，常年困于房内，终年不下楼，安装加梯后，一切难题迎刃而解。

振华重工于 2018 年底创立民生业务板块，并于 2019 年正式进入加装电梯业务领域。凭借独特的商业模式，“振华加梯”逐渐在上海浦东新区和静安区打开局面。振华重工与中国银行合作开展小额加梯信用贷款，解决有需求的业主一次性出资难问题；与大家保险公司合作，通过覆盖电梯 15 年全生命周期维保方案，发挥保险的“兜底”作用，让居民无后顾之忧。利用物联网云计算等技术，实时监测电梯运行状态，及时发现电梯潜在隐患；并与物业联动及时响应电梯故障报警、困人报警等情况，为电梯运行和乘客安全保驾护航。值得一提的是，振华加梯的钢结构整体吊装也广受居民欢迎。现场整体吊装，减少现场焊接，在减少施工污染的同时，工期也能缩短 40% 左右。

为既有老旧住房加装电梯，是提升市民生活品质，尤其是方便“悬空老人”下楼的重要民心工程。2022 年，上海市市长龚正去静安区驰骋新苑小区慰问困难群众，也乘坐了振华代建的景凤路 301 弄 9 号电梯。小区居委书记表示，“我们小区加梯完成率已经达到 83%，这在上海都算比较高的，是振华重工帮我们安装的加梯。”老房加梯，让幸福“一梯直达”，振华重工一直在路上。 振

（供图 / 徐婧　陆志东　李彤宇　唐莉琴）

振华重工承建浦东某小区加梯项目

在上海市临沂六村，党员楼组长赵阿姨正走出电梯

2023 年 4 月，唐莉琴和同事在三林镇进行加梯政策宣传

鹿特丹的海风

文 / **赵欣颖**

处于海洋性温带阔叶林气候的荷兰，素有“风车之国”的美名。这推动着“靓丽风景线”风车运行的海风，给在荷兰 ECT 码头进行整改项目的振华团队留下了难忘的记忆。

荷兰鹿特丹港是欧洲第一大港。位于鹿特丹港的 ECT EUROMAX 码头于 2008 年正式投入运营，全部港口机械设备都由振华重工提供，在当时是全球规模最大的自动化码头。此次整改项目涉及的 16 台岸桥已经在 ECT EUROMAX 码头驻守了十余年，见证了港口的风雨变迁。多年的使用，让岸桥部分结构件出现了一定程度的磨损和安全隐患。为了让这些“巨人”持续保持勃勃生机，2022 年 11 月底，整改项目经理宣长宇带领的 10 人团队落地荷兰。“这次任务，我们要向用户证明振华服务的专业性。”他说道。

工人在码头车间制作更换件

面对用户对机器性能的严格要求，项目团队对质量和安全措施把控一丝不苟。一到当地，团队成员仅用一周多的时间，就按照规定完成各项安全培训、办理进港手续，准备好符合码头安全要求的工具和装备，为开展施工做好充足准备。

12月初，整改工作正式开始。“我们整修的主要是前大梁铰点处斜梯，需要在离地超过50米高空中进行切割和焊接。”宣长宇介绍道，在平地上，吹的就已经是5、6级风，高空中的风力更让人难以招架。“00后”焊工张美龙是团队中的一员，从家乡云南临沧来到振华重工长兴分公司，他已工作三年有余，实际操作经验丰富。“风太大了，在大梁上常常要先抓住栏杆稳住，才能干活。”张美龙补充道。

港口临近海域，来自海上的水汽时不时就化作阵雨兜头淋下。为保障安全，一旦遇到超过 6 级风或是阵雨，高空作业就必须中止。此外，码头上业务繁忙，停机维修时间有严格规定，又时常遇到码头其

荷兰鹿特丹港 ECT 码头

他维保项目的交叉施工。团队成员紧抓时间窗口，争分夺秒。用宣长宇的话说，这叫“掐着时间干”，要赶在货运船到港之前，把这台机器的整改计划一口气做完，不留隐患。“每台机到梯形架的斜梯、平台都有腐蚀部分要割除，再将新的材料焊接上，或者更换整根斜梯槽钢。要不然，干了半截子停下，就不安全了。”

深冬的鹿特丹阴雨阵阵，寒风还带来几场飘雪，气温降至全年最低，1 月平均最高温仅 5、6 摄氏度。低温也给施工团队造成了不少麻烦，除了需要停工，还有冻伤风险。高空工作虽然戴着安全帽，耳朵却没法全部护住，成了寒风袭击的“突破口”。团队成员努力克服困难，后来有了“升级装备”带护耳的布罩作整体防护，进一步提升了安全系数与施工效率。

寒冷之中，亦有温情。农历除夕、初一恰好是周末，团队成员趁着周末假期各自采买下厨，端出了自己拿手的家乡菜，“南腔北调”拼成一桌。“大家都愿意自己动手，毕竟想吃一口自己的家乡风味。”回锅肉、酸菜鱼，配上当地啤酒，一桌香气四溢的年夜饭，给远在几千公里外的荷兰增添了几分中国春节特有的热火朝天。周期不等人，大年初二，团队成员又回到了岗位上，按照码头停机计划继续施工。异国他乡的春节，一个预料之外的声音送上了祝福。“新年快乐！”原来，了解到施工期间是中国春节，码头主管提奥送来荷兰特产点心。团队成员分享着他乡特产，感受着用户的深情厚谊，在充满咸腥味的海风中体味恰逢佳节的浓浓思念。

历时三个月的 60 多项遗留整改任务告一段落，不仅满足了用户的各项需求，还用实际成果取得了对方的信任。“后续的售后服务，欢迎你们再来鹿特丹！”在确认完工之后，用户代表对整改项目的团队成员们竖起了大拇指。

（供图 / 宣长宇）

整改项目团队进行班前安全作业交底

《兔年剪纸》作者：阮婵娟

《次北固山下》作者：方刚

员工书画

Work together for the digital transformation of the new era

by **Xue Weihui**

President Xi Jinping stressed "developing the digital economy is a strategic choice to seize the opportunities arising from the new round of technological revolution and industrial transformation". At present, digital economy is becoming a key force to reorganize global factor resources, reshape the global economic structure and change the global competition landscape.

The report of the 20th National Congress of the Communist Party of China proposes to accelerate the construction of a strong online country and a digital China. According to The Outline of the 14th Five-Year Plan for Economic and Social Development and Long-term Objectives Through the Year 2035 of PRC and Digital Economic Development Planning in the 14th Five-Year Plan, China will accelerate the development of digital economic development, fully release the data dividend, promote the deep integration of digital technology and real economy, and improve the digital penetration rate of traditional industries in the next five years. In February this year, the Overall Layout Plan of Digital China Construction issued by the CPC Central Committee and the State Council again stressed the importance of "promoting the deep integration of digital technology and real economy", and proposed to "speed up innovative application of digital technology in key areas such as agriculture, industry, finance, education, medical care, transportation and energy".

The picture of the integration of digitalization and real economy is slowly unfolding in all walks of life. As an important part of the real economy, manufacturing industry is deeply integrated with digital technology to achieve upgrading and enhance innovation ability. The digital transformation of manufacturing industry is to promote the two-way integration of business and system, is to drive business change under the guidance of the strategy, is to improve research and development, production, operation, and service with the driving force of data and assistance intelligence, and finally to improve the optimization of profit model and user experience. It will take digitalization as the core, realize intelligent empowerment via networking means, ensure efficient and quality delivery of products and services, and continuously enhance the core competitiveness of enterprises. The key to the digital transformation of manufacturing industry lies in the coordination of strategy and organizational capabilities, the construction of digital capabilities and a closed loop of value based on digital transformation.

As President Xi Jinping pointed, "there'll be no modernization without informationization". Under the guidance of this concept, ZPMC has actively joined the national digital economy development tide and the historical process of industry transformation and upgrading. At present, with the direction of its digital transformation clearly defined, ZPMC will integrate digitalization into every link of its production and operation, promote its transformation and upgrading, and strives ahead to achieve the goal of "building ZPMC into a world-class equipment manufacturing enterprise with global competitiveness in terms of science and technology, management and quality".

In the wave of digital economy in the era, digital transformation is not a "choice" of manufacturing industry, but a "compulsory course" for its survival and development, and an only way for manufacturing industry to achieve high-quality development. Just because the road ahead is long, is no reason to slow down. Just because there is much work to be done, is no reason to get discouraged. Today the manufacturing industry of China is taking the high-speed train of digital transformation in the new era and is striding forward high-quality development.

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"Digital Wings" boost high-quality development

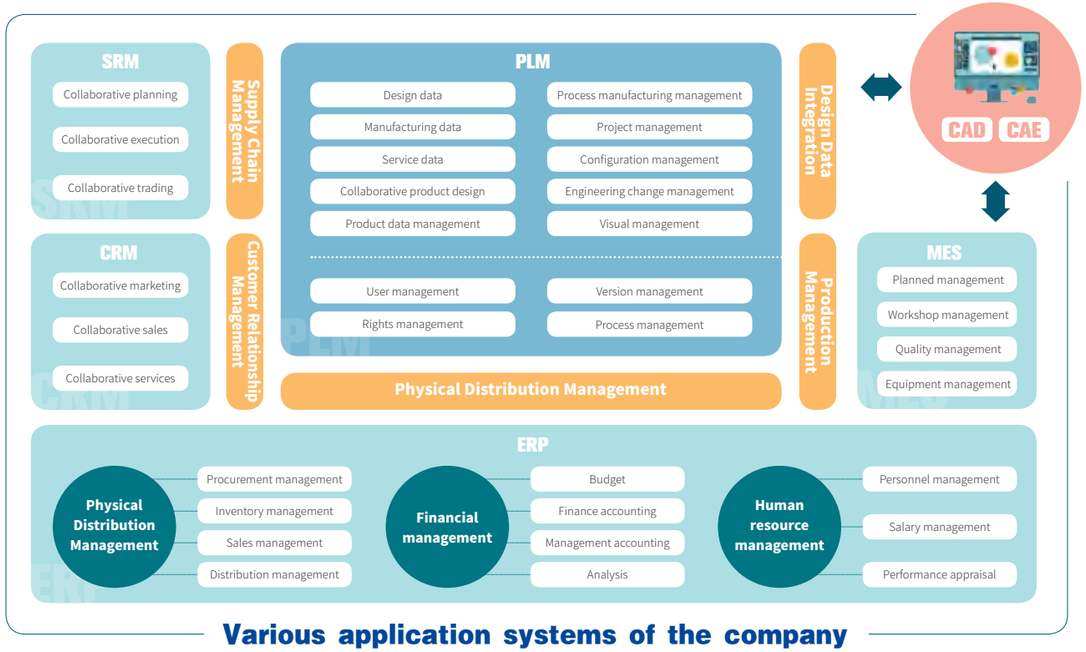
by **Xue Weihui**

At present, the next generation of information technology, represented by Internet, big data, cloud computing and AI, is accelerating driving innovation and application, and is increasingly integrated into all areas of economic and social development. The report of the 20th National Congress of the Communist Party of China proposes to "accelerate the development of the digital economy and promote the deep integration of the digital economy and the real economy." Facing the strong digital development trend and demand, ZPMC actively implements its strategic development plan in the "14th Five-Year Plan" period, accelerates the construction of equipment manufacturing enterprise facing the digital age, and empowers the whole company to develop with high quality through digitalization.

ZPMC developed the strategic informationization planning during the 13th Five-Year Plan period to strengthen its top design of informationization. In 2016, ZPMC began to promote master data governance, and established a unified data management standard for master data involving company materials, trading units and project numbers, and built a master data platform (MDG). From 2018 to 2019, ZPMC successfully implemented the first session of ERP (enterprise resource planning platform) project, and basically achieved the main goals such as "building a template and laying a foundation", "establishing an integrated platform for business and finance, strengthening management and control" and "fostering a team of compound-type talents with business and information management skills to meet ZPMC's future development requirements".

In recent years, ZPMC manages unstructured files through the construction of enterprise content management platform, standardized ZPMC's IT operation and maintenance process through the IT service desk project to improve the operation and maintenance efficiency. In addition, ZPMC also integrates OA, ERP, and other systems into its WeChat official account to effectively realize the mobile office of employees. In 2020, ZPMC was certified to implementing the standard of integrating informationization and industrialization management systems, indicating that ZPMC stepped on a new stage of integrating IT application with industrialization. ZPMC also completed the cloud

Zhenhua Heavy Equipment Manufacturing Base



Various application systems of the company

deployment of IT service desk, ECM, and other projects, forming a hybrid cloud system, and has included the resources of public and private clouds under its management by building a hybrid cloud management platform, thus entering the "cloud era".

Constructing "super brain" for operation management

The first task of digitalization is to realize the digitization of management. "One of the important roles of digitalization is to drive intelligent decision-making through data integration in the whole process of production and operation," said Yang Yuhua, general manager of Science, Technology and Digitalization Department of ZPMC. For this end, ZPMC vigorously promotes the construction of the ERP system, the CRM system, the SCM system and other management systems from point to the whole system, makes efficient use of various resources, and optimizes and re-creates its internal business processes and management processes.

ZPMC's customer relationship management system (CRM) includes the functions of customer information, customer visits, customer business opportunities, and quotation management, thus building a customer-centered digital marketing system. The system can meet the business needs of ZPMC's multi-organization and multi-format customer relationship management, and can improve ITS management ability and efficiency of the marketing system. By the end of April 2023, the system tracked 694 projects and processed 1,256 orders. ZPMC also established the port machinery project cost management system. By classifying and analyzing the relevant data of port machinery cost, it can design the cost subject framework, prepare the port machinery cost statement, assist the contract performance bodies and project managers to control the project cost in time, and effectively improve the project cost management. By the end of April 2023, a total of 327 port machinery projects were included in the management system.

In 2022, ZPMC successfully completed the financial cloud based business & finance synergistic project of CCCC, and 49 sets of domestic accounting data and 8 sets of overseas accounting data have all been put into use. The implementation of the project promotes the deep integration of business and finance, strengthens the role of finance in escorting production and operation, and helps ZPMC to upgrade its financial management digitally.

In addition, based on the supply chain management system (SCM), ZPMC built a company-level supply chain data center, which can not only meet CCCC's requirements of electronic procurement rate, but also realize the whole process tracking of materials from purchase, planning order, shipment to warehousing and use, greatly improving the efficiency of inquiry and tracking of materials. Combined with the data center, ZPMC launched its inventory utilization system at the end of April 2022, which greatly improved the efficiency of warehouse balance and achieved good economic benefits. By the end of April, 2023, a total of 6,625 applications for using the inventory were completed. At the same time, ZPMC also developed an online process for short-term inquiry and quotation of materials, optimized the whole-process system management of bulky materials, Implemented the entire online process, which effectively improved the efficiency of material procurement by over 20%, and improved the granularity of bulky materials management.

Creating a "superman" for R&D and production

In the era of digital economy, data has become the most important factor of production. ZPMC anchored the main direction of digital transformation, continued to focus on the digitalization of product development, and concentrated on promoting the intelligent transformation and digital transformation of manufacturing.

In terms of digitalization of design, research, and development, ZPMC has made great efforts to build 3D design and the information system of product life cycle management (PLM). In 2022, ZPMC completed the 3D model of the prototype design of STS crane, which made a "from 0 to 1" breakthrough in digital production of complete STS crane and established relatively inclusive digital data about product, indicating that ZPMC started a key step for digital transformation of product design. At the same time, ZPMC's full life cycle management information system has been completed and launched for official operation. Next, ZPMC will gradually realize the normalization of 3D design of the components for port machinery projects, to provide support for the digitalization of back-end manufacturing.

Technology has ignited the engine of transformation, and ZPMC has ushered in "intellectual manufacturing" quietly. ZPMC has built 20 pilot projects, including automated workstations, intelligent production lines and intelligent manufacturing demonstration workshops, which basically cover the key manufacturing processes of major products, achieving certain demonstrative effects. Among them, ZPMC's Changxing Branch has four intelligent production lines and six robot workstations, with remarkable results in improving quality and efficiency. Taking the box girder intelligent production line for example, the number of staff in the automated workshop has reduced by 26.7% compared with the traditional workshop, the total manufacturing cycle of a product is shortened by about 7 days, and the pass-yield is over 99%. In 2022, the output of the workshops increased sharply from 3,000 tons to 4,000 tons, up 33.3% QoQ. The trolley track welding workstation built by ZPMC's Nantong Branch can weld parts in batch in a professional and automated manner. The welding efficiency increases nearly 100 times, and the overall production efficiency of the trolley track increased 6 times.

In addition to intelligent transformation and upgrading, ZPMC, based on building the ERP system and the PLM system, gradually promoted building the manufacturing execution system (MES), which connects the design and R&D data and manufacturing data, realizes the visual, transparent and controllable production process, and creates a digital system for its intelligent manufacturing industry. In the next stage, ZPMC will initially build a manufacturing operation management system (MOM), to form an organic closed loop based on the digital system model of intelligent manufacturing.

"Combined" operation and maintenance services

Providing life-cycle maintenance for port machinery is not only an important guarantee for terminal production and operation, but also an important part of digital transformation of terminal management. "Our company should realize a new business model from selling products to selling services," said Yang Yuhua.

In 2017, ZPMC established its subsidiary Terminexus, which focuses on providing spare parts for port machinery and large equipment. As the implementer of ZPMC's "1544" overall development strategy for multiplying service innovation and post-market service business, Terminexus is committed to building a digital supply chain platform for port machinery industry, conducting business about the digital supply chain of port machinery, and integrating and optimizing the supply chain system using the data advantages in the global port machinery stock market to help terminal customers reduce costs and increase efficiency, and gradually expands its market share of port machinery-related post-market services. At present, Terminexus has cooperated with 326 terminal customers in terms of digital supply chain of port machinery to help terminal enterprises to improve their capability and efficiency in managing large equipment, and help boost ZPMC's one-stop service quality to a higher grade.

Terminexus achieves effective management and utilization of data through the MRO mode. At the same time, it actively establishes the SBOM system for port machinery, utilizes digital technology to integrate complete machine design data, actual consumption data of terminal customers, and suppliers' product design data, and works together with users to optimize spare parts inventory management and procurement strategies to reduce their maintenance costs and downtime.

Terminexus is also dedicated to improving data storage and management services. By building a "data warehouse", Terminexus "relocates" massive data such as spare parts data and contract orders online, thus realizing the "first step" of digitalization. By upgrading and building the "Data Lake", Terminexus turns the data in the database data, system operation log data, text and picture data into structured, semi-structured and unstructured data and stores them in a centralized way. The construction of "data warehouse" and "Data Lake" can help us rapidly search the model number of complete machine according to the drawing of users, and understand the demand differences between users to provide customized services.

In addition, Terminexus is committed to building an integrated service guarantee platform, integrating the upstream and downstream of the industrial chain, linking the data of global partners, providing more professional, efficient, and convenient one-stop service for users of terminal equipment, which will further enhance the adhesion with users, and contribute new values to ZPMC's industrial chain.

In the future, ZPMC will continue to promote the digitalization of operation and maintenance services. By building ERP, PLM, and MES, ZPMC will connect the important systems such as CRM and SCM at the upstream and downstream and at the same time use the capabilities of the data center to integrate internal production management data and external after-sales and operation and maintenance data, to form an industrial Internet platform with industry characteristics, providing technical support for the integrated service system.

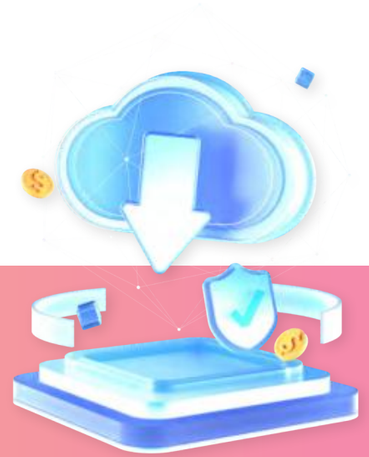
Scaling new heights and moving toward digitalization. ZPMC actively seizes the opportunity brought by digital technology, carries out the overall blueprint of "123456" digital transformation of CCCC, strives to build a digital port machinery ecological chain with "research, production, supply, marketing and service" as the core, delivers power for the digital transformation of large-scale equipment manufacturing industry, and turns digitalization a new engine for ZPMC's high-quality development.

(Photo by relevant units)

ZPMC's Changxing Base

When "Finance" encounters "Cloud"

by **Xue Weihui**



"It finally went online smoothly!" On September 1, 2022, Wang Danbin, the overall coordinator of ZPMC's Financial Cloud Business & Finance Synergistic Project Working Team, let out a sigh of relief. For him and his team partners, they were rewarded by half a year's hard work and efforts were rewarded at this moment.

Financial cloud business & finance synergy is the key task of digital transformation of CCCC during the 14th Five-Year Plan period, and it is also the top digital project to build a world-class "smart operation" system. "Compared with other sectors, finance has a relatively unified standard system and strong relevance. It can drive business reversely, consolidate the three foundations of processes, standards, and systems, and realize digital change, and this is not a simple financial cloud." said Yang Yuhua, head of the working team and general manager of the Science, Technology and Digitalization Department. The financial cloud business-finance synergistic project is a "two-step" project. The first step is to launch the financial cloud, and move the current local Inspur clients to the cloud to realize cloud-based, digitalized, and intelligent financial management. The second step is to realize the deep integration of business and finance in the process of project implementation, change the current different processes for approval and payment, and improve ZPMC's management efficiency.

Centralized office of the Financial Cloud Business & Finance Synergistic Project Working Team

ZPMC, as a "930-node" online unit of CCCC's Financial Cloud Business & Finance Synergistic Project in 2022, attaches great importance to the project and actively makes overall arrangement, planning and deployment. Led by the Science, Technology and Digitalization Department and the Financial Department, ZPMC coordinated its relevant departments and secondary units to set up a project team of more than 100 people rapidly. The project team is composed of four special sub-teams, namely system integration team, data governance team, financial cloud business team and infrastructure team. These teams are responsible for refining target tasks and reversely arrange project schedule by focusing on system integration, data standardization, data cleaning and financial cloud replacement.

"Compared with other brother units, ZPMC has laid a foundation in system integration," said Zhao Zijian, executive team head. ZPMC already built core application systems such as SAP ERP, MDG and ECM. As a result, the technical work mainly includes connecting with the unified system of CCCC, adjusting the ZPMC's original system and function points, and developing interfaces. During the construction of the project, 75 function points of the 5 business systems and 114 interface development were completed. "There is an innovation here. We have built a data center platform, which not only provides a user interface for data governance, but also minimizes the difficulty and risk of business system transformation through this platform, and realizes the unified docking with the system of CCCC."

"Data standardization is the key link to achieve the synergy between business and finance," said Wang Ping, deputy head of daily data management. The business systems used by ZPMC in the past had their own standards, and the data between different systems could not be connected. The financial cloud business & finance synergistic project sorts out the data in the whole system of ZPMC by standardizing financial data. "Data standardization cannot be achieved overnight. ZPMC's financial standards have been adjusted all the time. After each adjustment, we must reorganize all relevant parties to make adjustment."

With the finalization of the financial data standards, the data cleaning was officially started. Data cleaning involves three areas, namely project, contract, and related units. As a result, there was a large amount of work of various types to be dealt with, and many departments and units need to cooperate to accomplish the work. In order to clean the data smoothly, ZPMC organized six special seminars on master data process plans, trained more than ten trainings on business standards, and more than 300 people participated in the trainings. "Although I was psychologically prepared for the complexity of the work, its workload surprised everyone when the work really started." said He Dexi, who is mainly responsible for organizing data cleaning. For example, all contract data should be sorted according to the standards, namely contract partners, contracting date, whether the related units meet the standards, person responsible for the contract... All the contracts were clearly sorted by dozens of fields. Therefore, there would be a heavy workload to clean the data about more than 20,000 contracts of ZPMC. "It is a very difficult job for all of us to clean the data," said Zhao Yue, who participated in the data cleaning. "Many paper contracts were incomplete. For some contracts, only those who were responsible for them knew the contract amounts. In such case, the only way out was to find relevant records at the department or unit that handled the contract."

After more than 90 days of hard work, nearly 500 people from all departments and secondary units of ZPMC participated in the work of data cleaning, and successfully cleaned the data about 22,900 contracts, 21,800 related units and more than 22,000 projects.

Finally, based on the first three major tasks, the Inspur system was replaced by the financial cloud. The replacement process involved a lot of data conversion and function readjustment, which was a huge workload and was often affected by the loading speed. "There were all kinds of small problems in the replacement. It was the hardest job for the finance department last year," said Wang Danbin.

During the project, in order to break the information barrier and achieve horizontal collaboration, the project team began to work in a centralized manner in a conference room at the Headquarters in July 2022. Many people communicated frequently and worked intensively for more than 10 hours every day. "Apart from this part time job, most of the colleagues who participated in the financial cloud project had their own jobs. So, everyone worked very hard in half a year," said Wang Danbin.

Took six months to overcome difficulties, ZPMC's financial cloud was finally launched on September 1, 2022, one month ahead of the schedule. In the future, ZPMC will continue to strictly implement the requirements of the financial cloud business & finance synergistic project team of CCCC to ensure the high-quality operation of the financial cloud data and business. At the same time, with the help of "one cloud, one platform, one account and one statement", ZPMC will promote management penetration and boost its digital transformation and upgrading as well as high-quality development.

(Photo by Wang Danbin and Lu Zhidong)

ZPMC launched its financial cloud business & finance synergistic project smoothly

Starting a "digital transformation" journey for product design

by **Hong Dou**

"It is the first step that costs troublesome! Only by making full preparations for the first step of 3-D digitalization for design will the transformation be smoothly carried forward," sighed Yin Gang, vice president of the Mechanical Institute of ZPMC's Research & Design Institute when looking back the journey of building 3D digital prototype of STS crane.

After six months of work, ZPMC has completed the 3D digital modeling of prototype of typical STS crane, which is composed of more than 9,000 parts. As the core task of the first phase of the digitalization project of port machinery products, the modeling of 3D digital prototype of STS crane involves the 3D and full digital transformation of product design. By successfully converting 2D CAD drawings into 3D models with key information attributes, the work efficiency will be improved greatly. This project indicates that ZPMC started a key step in the digital transformation of product design, and achieved a breakthrough in the digitalization of STS crane products from 0 to 1.

Difficulties and hardships contribute to success. The 3D modeling of STS crane products was not a smooth sailing. For the project team, it was a difficult problem to find a complete set of process system in just half a year.

"How to achieve the connected digital system process? How can we ensure the consistency and uniqueness of data? We can only grope our way to advance the project, so it is inevitable for us to pay tuition fees and take detours. " When building the 3D modeling prototype of STS crane for the first time, the team had to "cross the river by feeling the stones It is common to correct mistakes and rework in the initial stage. "The faster you do it at the beginning, the more you will rework later."

Facing various problems following one by one, the team members did not cower but insisted on accumulating experience in 3D modeling by "trial and error", and finally completed the digital systematic process in practice. On the one hand, the team worked overtime after their daily design work to jointly advance the 3D modeling project. On the other hand, they recorded the problems, difficulties and solutions encountered in the process, completed the initial framework, developed a complete instruction manual, and started the first step of 3D digitalization of port machinery products by overcoming all kinds of difficulties again and again.

The team should "race against time to ensure quantity" and "standardize the norms to ensure quality". Although the cycle is tight, the team always strictly guarantees the standards and specifications of the 3D models of various parts. "STS crane is our competitive product. If we make it a benchmark, the other projects will refer to its standard." As the person in charge of the project, Yin Gang knows very well the importance of the first step of the project. During the process of building 3D prototype, he led the team to overcome many difficulties by following high standards, and solidly established the standardized norms for port machinery products.

When talking about the relationship between product standardization and 3D digitalization, Yin Gang believes that the two aspects promote each other and complement each other. Therefore, standardization is the only way to jointly promote ZPMC's digital transformation and high-quality development. "The higher the degree of standardization, the lower the difficulty of 3D digitization; moreover, the higher the degree of 3D digitization, the easier the promotion of standardization in the future." In fact, at the initial stage of building of prototype, the absence of comprehensive and systematic standards caused the mismatch of parts and assembly error of the 3D model, which hindered the progress of 3D digitization. It was the unified standards developed later that helped develop relatively complete digital data for STS crane products and accumulate systematic process experience for the standardization of STS crane products.

With a benchmark established, digitalization will be promoted to more areas. Today, the successful establishment of the prototype modeling marks the first step in the 3D digital transformation of design. How to popularize and apply 3D technology in an all-round way will be the key next step to accumulate strength to achieve digital transformation comprehensively from a point to the whole system. "We have to have a digital concept and make a top-level design," said Wu Fusheng, secretary of the Party Committee of ZPMC's Design and Research Institute.

But how can we speed up the conceptual transformation of designers? The key lies in the optimization and promotion of 3D design system. At present, there is still a threshold for designers to user the 3D design software, and many designers are not adaptive to using such software but prefer to use the traditional 2D CAD tools. Therefore, the project team will improve the existing 3D design tools, simplify the operation process, improve the design efficiency, and accumulate technologies for in-depth 3D design of port machinery products.

In addition, the team will consider the overall situation to turn "information islands" into "digital islands". Now the design has achieved a new breakthrough "from 0 to 1". "Next, we will develop digital interfaces between the three stages of design, technology and production and achieve the digitalization of the whole process from the design to the production," Wu Fusheng added.

As digital transformation is the general trend, ZPMC is catching up fast. "We are gradually going through a climbing process. We start from 3D digitalization of design, and enhance our competitiveness with the help of new information technology," said Li Yiming, dean of ZPMC's Research & Design Institute. "This year is CCCC's 'high quality development year'. We firmly believe that ZPMC will surely empower its high-quality development with digital transformation, and its high-quality development will create new advantages in the future!"

(Photo by Xiao Huiling)

STS crane 3D design model

A hidden "Data Lake"

by **Xue Weihui and Zhao Xinying**

"We are in a hurry to buy a reduction gearbox. Can you supply it to us quickly?" The person in charge of Maersk's container terminal at Morocco made a phone call to Terminexus in February 2020. According to the person in charge, an STS crane shut down. After inspection, it was found that the reduction gearbox failed and needed to be replaced.

In the traditional mode, the replacement of spare parts for the equipment of a terminal adopted the process of "inquiring the inventory at the site – purchasing new parts". In case of an emergency, the owner had to stop the crane and waits for the spare part. However, it would take 4–5 months to deliver a new reduction gearbox. During this period, the malfunctioning STS crane affected the normal operation of the terminal and caused some economic loss. Therefore, the person in charge of the terminal was anxious and hoped that Terminexus could shorten the supply process as much as possible.

A week later, Terminexus gave a surprise reply, "there is an idle gearbox of the same model in some terminal warehouse. You can quickly transport it to Morocco internally."

Why can Terminexus know the inventory of the Warehouse storage worldwide, and even know the product model? The secret behind is "big data".

In the past, there were various suppliers and distributors of spare parts for the terminal market. The spare parts are of varying quality. The information is dispersed and the synergistic effect is poor. Therefore, it is impossible to meet an immediate need of a terminal. In this regard, Terminexus has been trying to use digital means to eradicate the pain points of this industry.

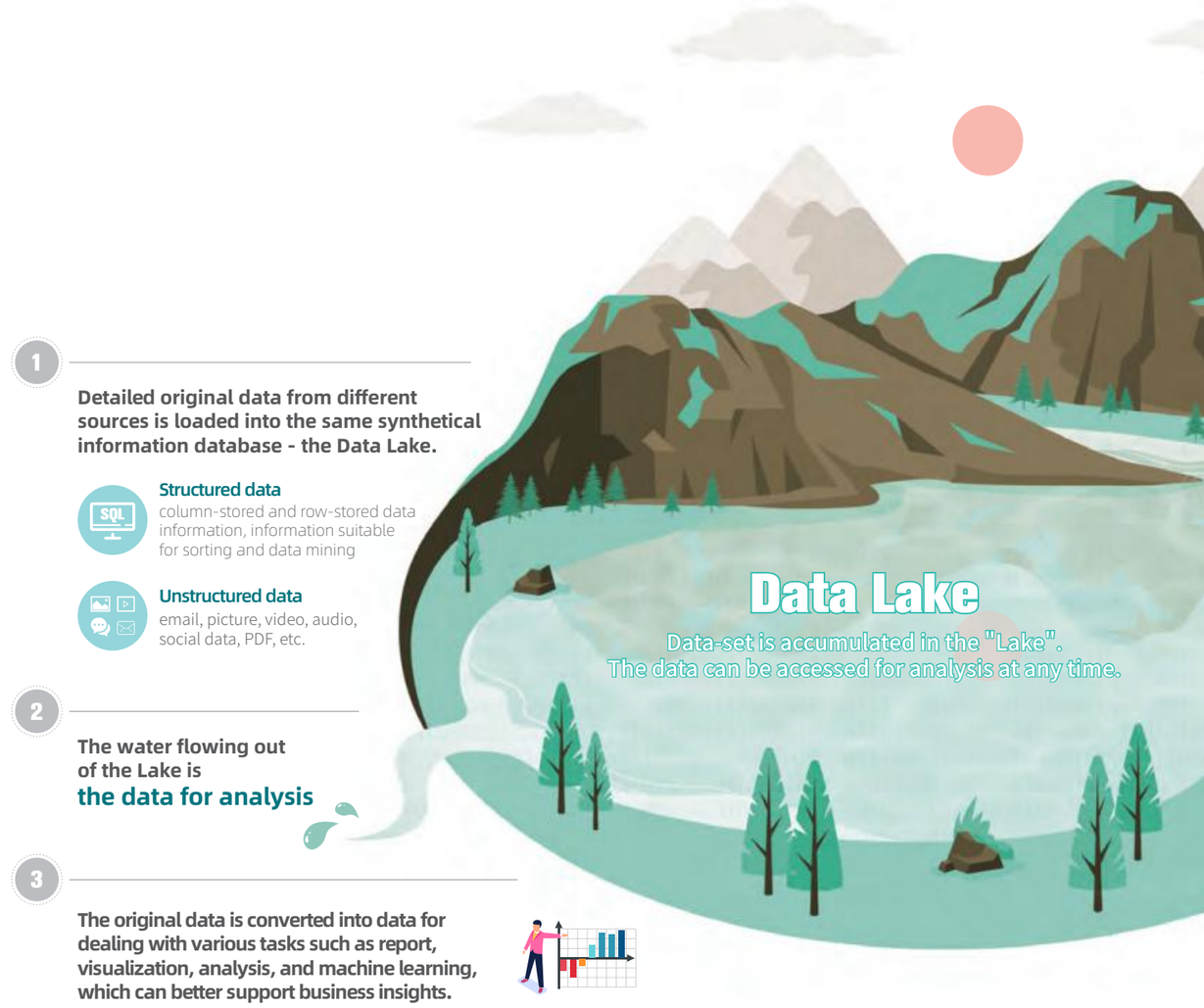
The integrated service platform of Guangzhou Nansha Phase IV Fully Automated Terminal were officially put into operation

In 2020, Terminexus established a "data warehouse" to "relocate" massive data online to realize the "first step" of digitalization. In 2022, ZPMC established a "Data Lake" by updating the "data warehouse" to further improve Terminexus' digital construction level.

"Data Lake" is a system that stores data in the original format, by which ZPMC can provide users more accurate services. "This 'lake' can store data of design drawings, contract data and business process data of port machinery and large-scale equipment projects, and it is constantly updated. Moreover, the lake collects original data without processing and loss, and more detailed information can be retained," said Wu Meng, IT manager of Terminexus. For design drawings, the "Data Lake" can even accurately record the information about spare parts. When users need spare parts, they can immediately retrieve information such as product model, spare parts inventory from the 'lake'. In the past, it took a day or two, sometimes a week to find the corresponding information.

Today, the "Data Lake" has accessed more than 5,000 drawings related to orders received by ZPMC, involving projects all over the world, such as the Port of Long Beach in the United States, Vancouver Port in Canada, Shanghai Port and Nansha Port in Guangzhou. With the help of "Data Lake", many urgent demands of users have been met in a very short period. Thus, it has been widely recognized by users.

However, the "lake" still has great potential. On the one hand, Terminexus continuously increases the internal data of ZPMC. Apart from the current drawing data, ZPMC will put the orders into the "lake". By analyzing the logistics and tariffs through the data, ZPMC will optimize the business process in reverse. On the other hand, it actively "mines" external data by adding the data of users and suppliers. "With more and more data put into the 'Lake', it can quickly match the spot goods in the inventory of ZPMC, users and suppliers," said Cao Yongping, marketing director of Terminexus.



In addition, the source data of the "Data Lake" is no longer limited to data of business orders. Terminexus tries receiving operation data of port machinery by installing sensors at user's terminal. In this way, the whole life cycle maintenance of port machinery can be extended from post-fault maintenance to pre-fault maintenance, further reducing the operating cost of users.

The "Data Lake" built by Terminexus is designed to integrate the resources of ZPMC, users, suppliers, and terminals, to achieve a quick and accurate response to users' service demands, and to provide users with more efficient and convenient one-stop services. In this way, users do not have to bear the storage cost of spare parts and the time cost required for replacement. At the same time, the analysis based on the "Data Lake" can also help Terminexus make more accurate decisions on purchasing spare parts to ensure the service quality of the whole industry chain while accurately stocking goods and using the inventory.

When the "Data Lake" is becoming deeper and deeper, Terminexus can provide users with integrated services featuring "low inventory, low cost, fast delivery, high efficiency and high quality" along the whole industry chain to ensure close cooperation between users and ZPMC during the whole life cycle of port machinery. "By providing quality services, the Data Lake can bring benefits to users, help suppliers improve management efficiency, and finally promote the coordinated upgrading of the whole industrial chain. This is the long-term goal of ZPMC in providing digital operation and maintenance service," Cao Yongping said confidently.

(Photo by Cao Yongping)

How will enterprise seize the first "opportunity" in the mobile machinery market with a good momentum for growth?

by **Liu Dongyi**

Port mobile machinery (hereinafter referred to as "mobile machinery") refers to small port machinery represented by straddle carriers, AGV, unmanned container trucks, front loaders/stackers, etc. As an important part of horizontal transportation at terminal, mobile machinery is widely used for stacking and transferring containers at ports, docks, railway and road transfer stations and yards.

ZPMC has been deeply developing the mobile machinery market for many years. At present, ZPMC's mobile machinery mainly includes straddle carriers and front loaders, which have been exported to more than ten countries and regions in Africa, Asia, Europe, and America. In addition, ZPMC's intelligent handling equipment such as AGV and IGV have also been widely used in many automated terminals at home and abroad.

What is the prospect of mobile machinery industry and the status quo of its domestic and overseas market?

The market of mobile machinery has a broad prospect. As for AGV, the market scale has increased by more than 30% in the past five years, and is expected to continue to expand in the next five years. As far as we know, it is estimated that nearly 700 AGVs will be needed in China from 2024 to 2027, with an output value of about RMB 2.5 billion.

In terms of straddle carrier, foreign markets have been growing stably for many years. In 2021, there were 12,193 sets of mobile machinery in the market. With such a large scale of market size, it is necessary to make a market planning in advance and implement a pre-production mode. However, there is no case of using straddle carriers in domestic ports at present, and there is great potential to tap the market. Since 2017, the demand of straddle carriers in global market has increased year by year, with an average annual growth rate of 4.5% and growth of average annual output value of about RMB 2.5 billion.

Considering the international market, mobile machinery including straddle carriers and AGV were born in and are popular in Europe. At present, straddle carriers are the most widely used at European ports, followed by AGV. In addition to the Port of Rotterdam in the Netherlands, the Port of Long Beach in Los Angeles, and the Port of Hamburg in Germany with top throughputs in the world, most ports in Europe and the United States are small and medium-sized ports, but the total number of these ports is extremely large. As a result, straddle carriers and container trucks are widely used in the European and American markets. In order to promote the construction of intelligent and unmanned ports, a number of ports along the Maritime Silk Road, such as the Port of Hamburg, the Port of Rotterdam, and the Port of Abu Dhabi, have started the test of unmanned container truck. At the same time, the shipping giants such as Maersk and Hutchison Whampoa are also paying close attention to and trying unmanned straddle carriers. In the Asia-Pacific region, the Port of Singapore and the Port of Busan, South Korea, of which the throughputs rank top in the world, are advancing the development of automated port with AGV, unmanned container trucks, because their huge scale is more suitable for giving play to the cluster advantages of AGVs and unmanned container trucks.

As for the domestic market, the planning, construction, and operation of coastal ports are in sound state, and the ports are developing in a healthy, stable, and sustainable trend. Driven by the strong transportation demand in China, the cargo throughput, especially the foreign trade container throughput, continues to grow rapidly. Therefore, the construction of ports is speeding up obviously, and the ports are developing towards large scale, intensification, modernization, and automation. According to the data of the Ministry of Transport, China has built 10 automated container terminals at present, and 7 automated terminals are under construction. The total scale of the completed automated container terminals and those under construction rank first in the world. Among them, several intelligent terminals are pioneering in Asia and even in the world. For newly built and reconstructed terminals, it is necessary to input port machinery. mobile machinery for horizontal transportation is the key to realize the efficient operation of terminals. Enterprise has led and deeply participated in this wave of automated terminal construction and accumulated valuable experience in this field. As a domestic leader of the industry, Enterprise has occupied a leading position in domestic market.

The two intelligent straddle carriers developed by ZPMC for Sweden

Facing the new situation, how can Enterprise find the right point to start mobile machinery business?

Firstly, enterprise must improve its capability of developing innovative equipment. Based on the design of port equipment, designers must be more capable of making innovative designs based on original machine models according to the actual situation of ports to meet their handling process requirements. For example, the series of straddle carriers with different heights, suitable for different handling and transportation needs, are applied to various ports with horizontal transportation or both horizontal transportation and storage. For example, an 8-wheel 4-axle IGV was upgraded for old port. With innovative chassis design, its vehicle height and wheel pressure on the ground were reduced, so that it can meet the requirements of civil engineering equipment. After installing unmanned navigation system, the innovative IGV will be a solution suitable for the horizontal transportation of updated automated terminals. These individualized customization requirements for different users can both reflect the strong strength of the R&D team of enterprise and enhance users' sense of experience and loyalty by providing quality and thoughtful service.

Secondly, enterprise will improve its capability of integrating products intelligently. Enterprise will make use of AI empowered various types of mobile machinery to develop systematic solutions suitable for multiple application scenarios, and suitable for different process routes of automated terminals. At the same time, the application scenarios of mobile machinery will be extended to logistics centers such as airports, railway station to improve cargo transfer efficiency and reduce operation cost.

Thirdly, enterprise will improve its capability of developing green products (carbon reduction). In recent years, green and low-carbon development has become the focus of port construction, and green port is the inevitable trend of port development in the future. Enterprise's full range of port machinery design should consider the actual needs of port users, refine the configuration of power, and match the zero emission of energy saving and environmental protection requirements of automated terminals. To put the green development concept into practice and meet different energy demands of different port users, the product design covers a full range of power configure including electric driving, hydrogen driving, diesel-electric hybrid driving, gas-electric driving, high grade pure diesel driving.

In the process of developing new energy power systems, the mobile machinery technological team of ZPMC guided by reducing energy consumption, gradually mastered the design and application technologies of multiple new energy power systems, accumulated multiple project applications of hybrid power systems and all-lithium battery systems, and developed a variety of energy supplement technologies for different handling processes, such as opportunity charging, overall power swap, high-power fast charging, natural gas hybrid power, etc., and have made new breakthroughs in the fields of wireless charging and hydrogen fuel cells.

Finally, enterprise will improve its capability of standard design. Compared with large-scale port machinery products such as STS cranes, mobile machinery is small and highly integrated. In the whole process of product development, the individualized needs of different scenarios should be met. At the same time, the standardization of products in design and assembly should be constantly enhanced to improve the accuracy of design and the efficiency of assembly. The serialization, standardization and modularization of product design will bring lower cost and faster delivery speed. By analyzing the handling process of container terminal, yard and logistics park, the design team carries out product design and R&D of key technologies to meet the process requirements of different operation scenarios. Among them, the team focuses on the design of key mechanisms, power systems and software systems, and makes use of the combination of key supporting parts and technologies to provide standardized and serialized machine models for various application fields.

(Photo by Lu Zhidong and Ding Xiaofeng)

An engineer is giving technical guidance in the workshop

Creating "core" for the main drive transmission of shield tunneling machine

by **Bao Jianjun**

"'Zhenxing' shield tunneling machine is equipped with the main drive gearbox developed by ZPMC!" At the beginning of March this year, Qian Rui, designer from the design & research department of ZPMC Nantong Transmission Machinery Co., Ltd. (ZPMC's Nantong Transmission), pointed to the news titled "The traffic flow exceeds 4 million cars only within two months" released by CNBN, said that the main drive gearbox of "Zhenxing" shield tunneling machine with a cutter head diameter of 15.03 meters used in the construction of the under-river tunnel along the Nanjing Heyan Road was developed by ZPMC. ZPMC takes a good lead in the field of main drive of super-large diameter shield tunnel machine.

A few days later, another batch of 14 main drive gearboxes for shield tunneling machine queued for boarding and shipment. The 14 dual speed ratio main drive gearboxes for shield tunneling machine have been upgraded to "automatic gearshift". ZPMC's Nantong Transmission successfully developed the world's first product of this type in December 2022, making it a leader in the market.

The main drive gearbox is a core component of shield tunneling machine for operation It provides a powerful torque for the cutter head to "drill" underground rocks and soft soil. "Whether it can 'chew' the rocks, the 'gum' plays a key role, and the main drive gearbox is like the gum."

In recent years, among the super-large shield tunneling machines with a diameter of more than 15 meters, such as 16.09-meter Yunhe shield tunneling machine for the eat tunnel of Ring 6 reconstruction project in Beijing, the 15.76-meter Xingye shield tunneling machine for the main line project of Xingye expressway project in Zhuhai, The 16.09-meter "Juli 1" shield tunneling machine for the left cross-river tunnel project of Jingjiang River in Jiangyin, which were all equipped with the main drive gearbox developed by ZPMC.

On the eve of the Spring Festival this year, ZPMC's (Nantong) Transmission was awarded an order of more than RMB 100 million from a customer, which is also the largest order of gearbox for shield tunneling machine in China by far. 2023 is destined to be another crucial year for ZPMC's people to "roll up sleeves to speed up work". "Our market share of main drive gearbox of shield tunneling machine will exceed 50%!" said Qian Rui, clenching his first, and he is advancing the design tasks of more than 30 projects.

"We can complete one or two projects every day, and now our design is easy and our production is efficient!" Qian Rui said frankly that a modular design concept was applied in the development of the main drive gearbox for shield tunneling machine, turning the design and machine into "building blocks". "In more than 8 years, ZPMC's Nantong Transmission has completed more than 360 gearbox projects, covering 36 speed ratios and more than 20 kinds of power. The planetary parts of the gearboxes are completely modularized, with only more than 10 bearing models and only 3 or 4 oil seal models!"

After eight years of hard work, ZPMC's main drive gearbox for shield tunneling machine has achieved a magnificent turn from domestic products for replacing foreign products, tracking foreign products, modular development to competing with foreign products, even to the industry leading original "dual speed ratio" product.

In 2016, facing the unfamiliar market, ZPMC's Nantong Transmission set up a R&D team to dock the host machine manufacturers to study target parameters, output requirements, speed ratio, structure, materials, and machining scheme. The first generation products developed by the team were mainly imitations. The first two 90kW main drive gearboxes adopted a single cantilever structure. In order to ensure performance, the team put them on a self-prepared test bench for a durability test for more than 10,000 hours. In August of that year, the main drive gearboxes for shield tunneling machine successfully passed the appraisal organized by Jiangsu Provincial Machinery Industry Association and obtained the market access qualification.

"Looking back now, our products at that time can only be used for replacing imported products," said Qian Rui. "The main drive gearbox of shield tunneling machine has an index called torque density. Such index of foreign products is about 125 Nm per kilogram, and the product performance remained unchanged over 20 years. However, the index of our optimized products can reach 160 to 170 Nm per kilogram."

In order to improve the performance of our products, the team of ZPMC studied and adopted nine new technologies in its brand new main drive gearbox for shield tunneling machine, including bears, oil seal structure, new materials, and heat-dissipating method. "Simply speaking, our newly designed product has a more compact structure, smaller volume and lower weight, and greater output torque."

To apply new technologies, it is necessary to constantly improve the process, accuracy, and efficiency of manufacturing. In addition, the modular design also improved manufacturing efficiency and quality. "When receiving orders with ultra-short delivery cycle, we can take our time and replace parts between different gearboxes. It is also very convenient to carry out maintenance!" Xie Jiming, marketing manager of the manufacturing base, believes that it is worth popularizing the design and manufacturing concept in developing new products.

At the end of last year, the newly developed dual-speed ratio main drive gearbox for shield tunneling machine integrated two sets of reduction systems, so that it can be automatically switched in operating between soft soil and hard rock. In this way, the cutter can operate rapidly when cutting hard rocks and can get out when stuck by unknown objects in soft soil.

When recalling the experience that the cutter head was "locked" during the construction of the tunnel of Line 3 of Zhengzhou Subway in the summer of 2016, Qian Rui said: "if we used the current dual speed ratio main drive gearbox, it would not have been 'locked' at all. Because the automatic switching of dual speed ratio gearbox will provide up to 2.2-2.5 times of torque and can automatically crush the concrete stumbling blocks."

"Innovation is not a node but a direction of ZPMC's Nantong Transmission always adheres to. In terms of developing products, upgrading products, or manufacturing process and means, innovation is always an engine to drive high-quality development!" said Dai Lixin, general manager of ZPMC's Nantong Transmission.

(Photo by Bao Jianjun)

Professional technical personnel from the manufacturer of the sealing kit to provide on-site communication and guidance on the installation of the sealing ring

A "new member" of the port handling equipment family

by **Lu Yiyan**

In the springtime in March, everything is full of vitality. There is no person at Nansha Phase IV Terminal of Guangzhou, but it still looks so busy. At the rightmost area of the terminal, five portal cranes are standing on the previously empty quayside, and several IGVs are shuttling back and forth in an orderly manner under the booms of the portal cranes. They can load or unload a single container in less than one and a half minutes, and the whole process is as smooth as flowing water.

At the site of Guangzhou Nansha Phase IV Terminal, multiple IGVs are undergoing container loading and unloading work

"This is our latest handling process using IGVs to support portal machines. Different from the fully automated handling process using IGV to support STS cranes and RMG crane, this handling process involves "man–machine interaction" and faces more complex situation. As it is the originated handling process in the world, we had no experience to learn from during design and R&D of the project, which was a great challenge to our design and R&D team," said Dai Qiang, a member of the Nansha Phase IV Terminal Project Department.

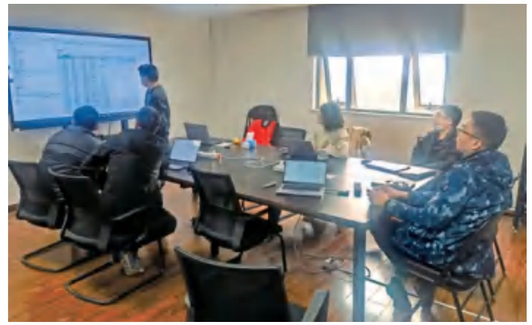
At the beginning of the planning of Nansha Phase IV Terminal, the user designated the rightmost area of the terminal as the barge handling area, because barges can support portal machines flexibly and efficiently to due to their small size. However, unlike fully automated handling process in other areas, the five portal cranes in this area are operated manually, which requires the dispatching system behind to be more intelligent. The project team had to make corresponding customized modification and development based on original interactive logic to ensure that the portal cranes can be manually operated with certain freedom instead of affecting the automatic operation of the whole terminal.

It is a long journey to make the "intelligent brain" of the scheduling system smarter. As it can't judge the operations except normal operations, the team had to tackle this problem among others. "Because the portal crane is operated manually, its movements are not as fixed as those of the automated STS crane, so its movement are of great randomness and uncertainty, which makes the logic of the scheduling system very complex, because it has to judge the completion of tasks according to the position of handling movement." "At that time, we wanted to introduce a special mode for the system. When the driver finishes his operation, he will confirm the completion of the task himself, which means to switch to the 'manual mode', thus weakening the system judgment," said Ning Wenyang, a system analyst.

However, considering the intelligent operation of the whole system, the project team held many meetings and discussions, and finally discarded that scheme, and decided to solve the problem through design and logical optimization. The software development team made great efforts to optimize the system.

Before the project was put into production, Ningwen Yang received a phone call from Cheng Long, a member of Nansha Phase IV Terminal field test team. "Engineer Ning, the user said that our IGV would not leave until the portal crane put the grabbed container on the ship. This process is of low efficiency. Do you think we can optimize this as soon as possible?" After ringing off, Ning Wenyang immediately held a meeting to discuss with the developers and testers.

"We can move the time node when the IGV is allowed to leave to the time when a container is lifted to a safe height. In this way, IGV can release its transport capacity in advance and shorten the interval between tasks, which requires to adjust the interaction flow between the dispatching system and the PCMS (portal crane management system)," Ning Wenyang said frankly.



The project design and development team are discussing solutions based on user's requirements during the meeting

"We can give a 'complete' signal to the interaction system when the container is lifted to a safe height, and the dispatching system can combine this signal to make a comprehensive judgment and arrange a follow–up task for IGV." "However, the portal crane should maintain its operation status until the loading action is completed, and the task information system still needs to act according to the position of the container unloaded by the driver to ensure the accuracy of the task information," Pu Yi, a dispatching development engineer, and Tang Zhizhuo, a PCMS development engineer, expressed their views, respectively.

"In addition, even if the dispatching system allows IGV to leave, whether the actual area lock can be relieved still depends on TOS's judgment on the result of cargo handling. I'll discuss with the person in charge of TOS about the changes of the process on our side so that they can make adjustment in time." At the meeting, everyone brainstormed and soon they prepared a plan finally.

A week later, the new version of the system was released, and the terminal tested it immediately. The new system successfully solved the problem that IGV waits for action, and IGV can be released for next operation until the portal crane lifts the container to a safe height.

The world's first portal crane–IGV handling process was successfully put into operation, which not only helped Guangzhou Nansha Phase IV Terminal to operate efficiently, but also provided solutions and reference for the automatic upgrading and transformation of traditional small and medium–sized terminals in the future. 振

(Photo by Dai Qiang and Xie Xin)

"Steel Roses" in the field of port machinery

by **Li Tianyi**

In 1995, Fu Maohua, then 23 years old, entered ZPMC after graduating from university, and she found a career worth fighting for here. After working for 28 years, from making drawings to hosting projects, from design and research to technological management, from working single-handedly to leading a team, she presided over the design of more than 40 STS cranes, cooperated with users in the design of 3E STS cranes, and participated in several automated terminal projects such as Yangshan Port. Now, she is deputy chief engineer of ZPMC and dean of the Mechanical Design Institute of ZPMC's Design & Research Institute。She lives a wonderful life at her ordinary post, grown into a"Steel Roses" blooming proudly in the field of port machinery.

If you walk into the office of Fu Maohua, you can see the phalaenopsis bloom on the windowsill. In the office, most books with words of "Lifting Machinery" are neatly placed in the bookcase. Fu Maohua took out a "book" with a yellow cover and a transparent glue repaired spine – Metal Structure of Crane. "I moved to new office several times. This textbook in my university time has been with me for many years, and sometimes I will open it. If you always insist on doing one thing, you will feel at ease in your heart," Fu Maohua, with a dynamic shoulder-length short hair and dimples on cheeks, said with a smile.

"I have experienced many small but significant moments in my life." Looking back at her 28 years of work, Fu Maohua first remembered the edification of her predecessors. At that time, if there were any changes in the design drawings, designers had to fill in the amendment form by hand. Once Fu Maohua did not fill in an amendment form properly with illegible handwritings. Yan Yunfu, manager of the technical department of ZPMC at that time, rejected Fu's amendment form twice. Another senior engineer, Zhang Minghai, then deputy dean of the Onshore Engineering Institute, helped her understand the meaning of "innovation". Zhang Minghai often guided her: "Can we solve the problem in a new way?" At that time, the seeds of innovation quietly took root in Fu Maohua's heart.

Fu Maohua always keeps in her mind the words and deeds of her predecessors. As a result, she is always meticulous and strives for perfection in her work. On February 1, 2011, two days before the Spring Festival, Fu Maohua did not remember the festival. Instead, what she was thinking about was the contract ZPMC signed with Shanghai Waigaoqiao Terminal. "That was the first project of energy-saving STS crane! The delivery cycle was only 10 months. The energy-saving requirement was as high as 10% or higher. More important, there was a shortage of manpower," she bent over her desk and independently worked out the general layout of each component and the overall scheme of the project. A week after the Spring Festival, she organized a technical team to demonstrate the scheme with the user.

In this way, she spent the Spring Festival holidays in an academic atmosphere.

Soon after, ZPMC handed the project of Maersk, a key account of ZPMC, to Fu Maohua. When it comes to Maersk, everyone is familiar with it. Maersk is the largest shipping and terminal management company in the world. It adopts the mode of global bidding and centralized procurement to purchase large port machinery. Fu Maohua was appointed as the key account manager and technical director of the project of Maersk, and the framework agreement between Maersk and ZPMC should be completely updated.

Because Maersk has high requirements for standards, the agreement included all the specifications and details of the standards and options, and should be updated every two months. Within two years, Fu Maohua "digested" one English standard after another, and went to The Hague, the Netherlands, for technical negotiations time and time again. "We went through all items of the standards one by one, and check the details carefully." After updating 13 versions, the final 170-page Standard Technical Specification, Hazard Analysis Report based on ISO Standards and other technical documents were developed. The technical negotiation and implementation processes for subsequent cooperative projects between ZPMC and Maersk were greatly simplified, and these documents are still in use today.

At present, Fu Maohua acts as the vice chairman of the Port Machinery Branch of China Construction Machinery Society. She has become a technology giant with multiple honors such as the first prize of China Port Science and Technology Progress Award, the second prize of Shanghai Science and Technology Progress Award, the March 8th Woman Pace-setter of Shanghai, and CCCC Innovative Talent Award. At the same time, she is a holder of five patents and publicized 3 papers such as Application of Dual-Lifting STS Crane Technology at Automated Terminal and participated in compiling two works including Smart Green Container Terminal.

Time elapses quickly. Fu Maohua has been braving the wind and waves in the "ocean of STS cranes". "That which we persist in doing becomes easier to do." Fu Maohua, cupping her check in hand, looks at the front. "I always believe that the beauty of life and scientific research lies in simplicity, quietness and persistence."

(Photo by Fu Maohua)

Fu Maohua was at the CTA terminal in Hamburg, Germany

Fu Maohua was discussing the drawing with her colleagues

Fu Maohua was giving a keynote speech at the "Intelligent Terminal Solutions Exchange Forum"

Sending happiness "by elevator"

by **Li Tianyi**

"Miss Tang, park here!" On the morning of April 10th, Tang Liqin, operator of ZPMC's New Industry Business Unit, drove into Zhaojiayuan Community in Caoxi Village IV, Xujiahui district and passed along red brick buildings one by one. Uncle Wu, who is tall and wears gray hair at the temples, and Aunt Tang, head of a building, waved hands warmly at the foot of a building. Tang Liqin, after parking her car, immediately took out the documents and communicated about the progress of installing elevator for the unit. No one knows how many times this scene happened in the past year and a half. However, unlike the past, the ceremony of installing an elevator Xuhui district by ZPMC would be held here. It seems it was simple to start installing an elevator to a building, but behind it was the persistence and dedication of the residents and ZPMC for more than two years.

For a long time, the residents hoped to install an elevator to the old buildings. There was already a plan of installing an elevator to the No.50 building of Zhaojiayuan, Caoxi Village IV of Xuhui District. However, the footpath on the 2nd floor became an obstacle for installing the elevator. Many professional companies engaged in installing elevators suggested that if the residents wanted to keep the footpath, some of the small garden on the north side must be demolished. The small garden is a good place for the local residents to do physical exercise every day. When they heard that the garden had to be demolished before the elevator could be installed, they felt frustrated. Is there a chance for the seniors "living in air" to have an elevator while keeping the footpath and the garden?

Uncle Wu, who once worked in Shanghai Port Machinery Factory, has a deep affection to ZPMC. As soon as he heard that ZPMC had the business of installing elevators, he immediately contacted ZPMC to install an elevator. To this end, he specially came to Pudong to inspect ZPMC's completed project of installing elevators, and wrote to ZPMC's leaders, eagerly hoping ZPMC to install an elevator in Zhaojiayuan. The leaders of ZPMC listened to the voices of the residents of the community such as Uncle Wu, and sent Tang Liqin to contact Uncle Wu, the owners' representative immediately. After repeated investigations in the residential area, Tang Liqin, together with the project team of ZPMC, worked out a preliminary plan for installing elevator. "Uncle Wu, we will demolish part of the second-floor pathway near Rooms 04 and

In February 2022, Hangzhou Yingwei, Deputy Secretary General of the Shanghai Municipal Government, Deputy Secretary of the District Committee, and District Head, arrived at Vilage IX, Weifang and took an elevator installed by ZPMC

05, and keep the small garden. Would you please communicate with the other residents of the building to see if they can accept this plan?" If you have any questions, you can contact me at any time!" Since then, Tang Liqin frequently visited the site, and her phone was full of records of calls with Uncle Wu and Aunt Tang, head of the building.

"How about the quality of the elevator? It is linked to life safety!" The residents raised questions. After preliminary judgment, the construction team had to set up a scaffold at the site and tried to hoist segmented steel structures for the elevator. "ZPMC's main business is building steel structures. And it always controls the quality of the main body steel structures of the elevator strictly." ZPMC's steel structure engineer explained.

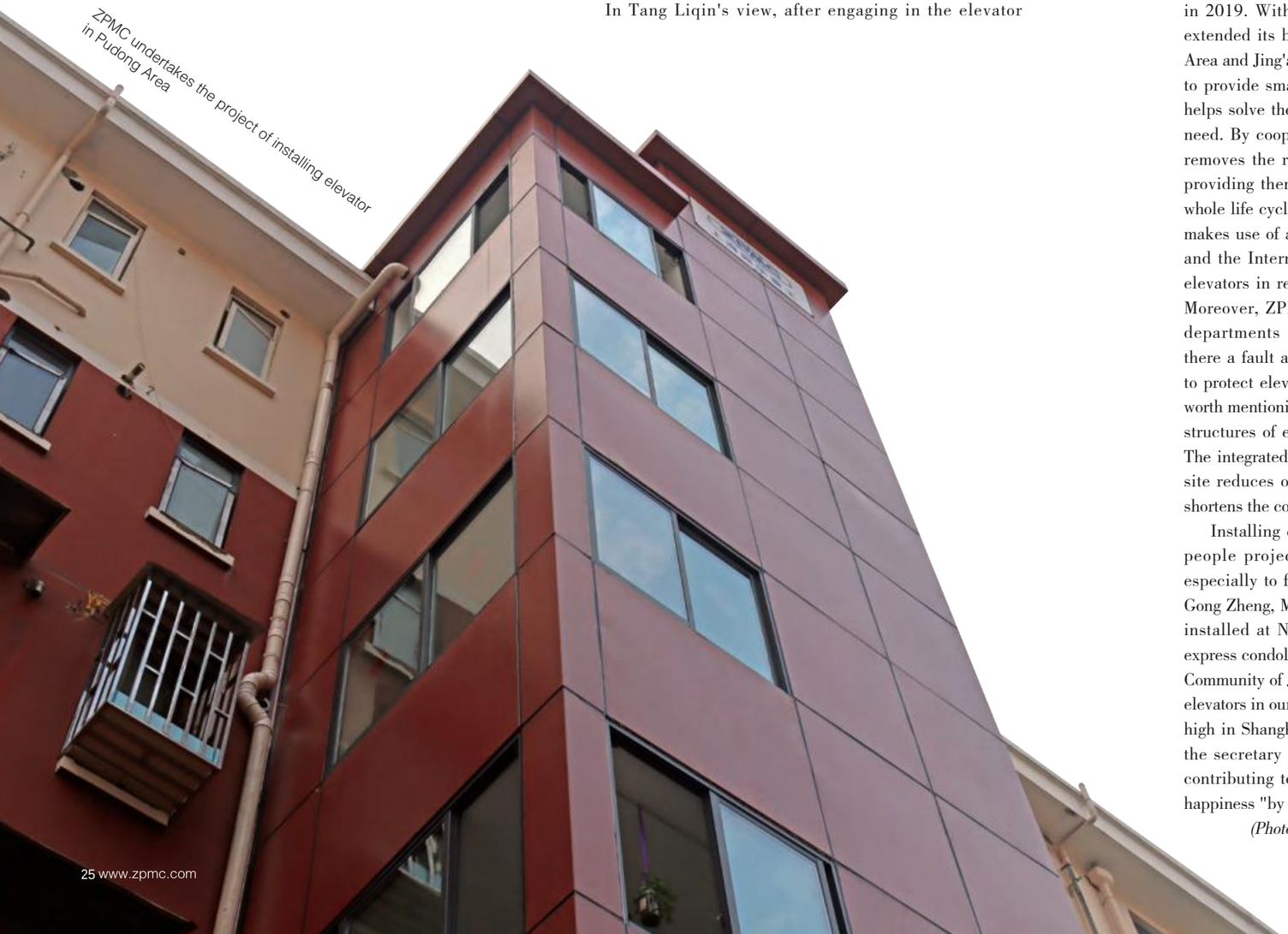
"Let me thank you on behalf of the residents of No.50 building of Caoxi Village IV! Thanks a lot!" When mentioning the smooth start of this project, Uncle Wu said excitedly: "I have been in contact with Miss Tang. She is very strict about the construction. She handled all the formalities and followed all relevant regulations of the city. If an employee is so responsible, the enterprise must be a responsible and caring one! "Uncle Wu praised Tang Liqin by thumbing up. Aunt Tang also strongly supported Tang Liqin. "Your company has high credibility and is a large State-owned enterprise. We believe in the quality of the elevator you build!"

In Tang Liqin's view, after engaging in the elevator business, apart from improving her business ability, she also made a lot of friends regardless of ages. In a video on her mobile phone, three aunts who were over 60 years old were coming of the elevator installed at Linyi Village VI, Pudong New Area in turn, and their faces were full of joy. In the middle of the video, the subtitles of "one button to your happy home" continue to flash. "These aunts also shared photos of their flowers with me yesterday." Tang Liqin said with a smile. The uncles and aunts in Weifang New Village also really felt the convenience brought by the elevator. Before installing the elevator, they had been staying in their rooms all the year round due to their old age. But now, all the problems have been solved.

At the end of 2018, ZPMC founded the livelihood business sector and formally entered the field of installing elevator in 2019. With its unique business model, ZPMC gradually extended its business of installing elevators in Pudong New Area and Jing'an District. ZPMC cooperated with Bank of China to provide small-amount loan for installing elevators, which helps solve the problem of one-time investment for owners in need. By cooperating with Dajia Insurance Company, ZPMC removes the residents' worries about the project quality by providing them with an insurance scheme covering 15-year whole life cycle maintenance of the project. In addition, ZPMC makes use of advanced technologies such as cloud computing and the Internet of Things to monitor the running status of elevators in real time to find their potential hazards in time. Moreover, ZPMC's elevators link the property management departments so that they can respond immediately when there a fault alarm or an alarm of trapping passenger in time to protect elevator's safe operation and passenger safety. It is worth mentioning that the integrated hoisting of segmented steel structures of elevator is also favorably received by residents. The integrated hoisting of segmented elevator structures at the site reduces on-site welding and construction pollution and shortens the construction period by about 40%.

Installing elevators to old buildings is an important pro-people project to improve the living quality of citizens, especially to facilitate the elderly to go downstairs. In 2022, Gong Zheng, Mayor of Shanghai Municipality, took the elevator installed at No. 9 building of Lane 301, Jingfeng Road, to express condolences to the people in need in Chicheng Xinyuan Community of Jingan District. "The completion rate of installing elevators in our community has reached 83%, which is relatively high in Shanghai. ZPMC helped us install the elevators," said the secretary of the Residents' Committee. ZPMC has been contributing to installing elevators to old buildings, sending happiness "by elevator" to the residents.

(Photo by Xu Jing,Lu Zhidong,Li Tongyu and Tang Liqin)



ZPMC undertakes the project of installing elevator in Pudong Area

In Linyi Village VI, Shanghai, Aunt Zhao, Party member and head of the building, is exiting the elevator

In April 2023, Tang Liqin and her colleagues were conducting a policy promotion for installing elevators in Sanlin Town

The sea breeze in Rotterdam

by **Zhao Xinying**

The Netherlands, located in the zone of oceanic temperate broad-leaved forest climate, is known as the "country of windmills". The sea breeze that drives the local beautiful windmills, left unforgettable memories to the team of the Dutch ECT terminal rectification project.

The Port of Rotterdam in the Netherlands is the largest port in Europe. The ECT EUROMAX terminal at the Port of Rotterdam was officially put into operation in 2008, and all the port machinery used by the terminal was provided by ZPMC. At that time, ECT EUROMAX terminal was the largest automated terminal in the world. The rectification project involved 16 STS cranes, which have operated at ECT EUROMAX Terminal for more than ten years, and have witnessed the vicissitudes of the port. After years of use, some structural components of the STS cranes have been worn to some extent and may have potential safety hazards. In order to keep the vitality of these "giants", Xuan Changyu, manager of the rectification project, led a ten-member team to arrive at the Netherlands at the end of November 2022. "In this mission, we want to prove the professionalism of ZPMC's service to users," he said.

The workers are making replacements in the workshop at the terminal

As the user had strict requirements for equipment performance, the project team had to be meticulous in controlling project and quality and taking safety measures. When they arrived at the destination, it only took them more than one week to complete the safety training, handle formalities entering the harbor, prepare tools and equipment that meet the safety requirements of the terminal, and make adequate preparations for the construction as required.

At the beginning of December, the rectification work was officially launched. "What we need to renovate is the inclined ladder at the hinge point of the front girder, and we need to cut and weld it at a height of more than 50 meters above the ground," said Xuan Changyu. On the ground, French breeze or strong breeze blows all day long, and at height the wind will be so strong that one cannot endure it. Zhang Meilong, a welder born after 2000, is a member of the team. He came to Changxing Branch of ZPMC from Lincang, Yunnan Province. After working for more than three years, he has accumulated rich practical experience. "The wind is too strong. On the girder, you must grab the railing and stabilize your body before you can work," Zhang Meilong added.

The port is close to the sea area, and the water vapor from the sea showers onto their heads from time to time. In order to ensure safety, work at height must be stopped in case

ECT Terminal at Rotterdam Port, Netherlands

of a wind exceeding stronger breeze or a shower. In addition, as the terminal is busy, there is a strict regulation on the downtime and maintenance time of the STS cranes, and there were other maintenance projects being carried out simultaneously. The team members seized the time window and raced against time to complete the project. In Xuan Changyu's words, they had to "squeeze time" to complete the work. Before the cargo ship arrived at the harbor, they had to complete the rectification in one breath without any hidden hazards. "The inclined ladder of the trapezoid frame and the platform of each crane have corroded parts. They had to cut them off and weld new materials or replace them with an entire U-bar for the inclined ladder. Otherwise, it's not safe for us when we do it halfway. "

In Rotterdam, it rained now and then in late winter, and the cold wind also brought several snowfalls. The temperature dropped to the lowest in the whole year, and the average highest temperature in January was just 5-6 degrees Celsius. The low temperature also caused a lot of trouble to the team. In addition to downtime, they had to face the risk of frostbite. Although they were wearing helmets, their ears could not be completely protected. As a result, their ears were attacked by the cold wind. The team members worked hard to overcome the difficulties. Later, they "upgraded" their personal protective equipment with cloth earflaps to protect their heads completely, which further improved the safety factor and the construction efficiency.

There was also warmth in the cold. The Lunar New Year's Eve and the first day of the Lunar New Year happened to fall on the weekends. The team members took advantage of the weekend holidays to buy food materials for cooking. They cooked their hometown style dishes they were good at and dined together. "Everyone was willing to cook dishes themselves. After all, they wanted to taste their hometown style dishes." They laid Sichuan style double cooked pork slices, pickled fish, and local beer on the table as the New Year's Eve dinner, which brought some enthusiasm of the Chinese Spring Festival to the Netherlands thousands of kilometers away. As the project cycle waited for no one, the team members returned to their posts on the second day of the Lunar New Year, and continued their work according to the shutdown schedule of the terminal. During the Spring Festival in a foreign country, an unexpected blessing came. "Happy New Year!" When Theo, head of the terminal, learned that the team members spent Chinese Spring Festival during the construction, he sent special desserts of Netherlands to them. The team members shared the local special desserts, felt the close friendship of the user, and missed their hometown in the salty sea breeze.

Finally, the team members completed the rectification project composed of more than 60 tasks after three months of hard work, which not only met the demands of the user, but also won its trust due to the practical results they achieved. "You are welcome to Rotterdam again to provide us with after-sales service!" the user's representative gave a thumbs-up to the team members of the rectification project after confirming the completion of the project.

(Photo by Xuan Changyu)

The team's pre-shift safety operation disclosure