AGILE FACTORY MODEL...

... an effective solution for large, distributed software development

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SITA • www.sita.aero
The Agile Factory Model vs. Waterfall at SITA

- Vital productivity gains: 2.6 to 3.5 fold increase
- Cost reductions: 55%
- Quality improvements: 60% less defects
- Scalability: 52 scrum teams (650+ staff) at peak time
- Consistent fortnightly deliveries
Context & Drivers for Change
Who are SITA?

“We don’t deliver garbage”
Who are SITA

INDUSTRY-OWNED, INDUSTRY-DRIVEN
• Owned by hundreds of air transport industry members.
• Driven by over 40 air transport industry CIOs and senior IT professionals, who sit on SITA’s Board and Council.
• Working with our Customer Advisory Board, industry bodies and user groups to meet real air transport requirements.

OUR CUSTOMERS
• Airlines
• Airports
• Ground handlers
• Global Distribution Systems (GDSs)
• Air navigation service providers
• Governments and border agencies
• Aerospace, aircraft and airframe manufacturers
• Air cargo
• International organizations
• And more

> 2800 CUSTOMERS WORLDWIDE

BY SECTOR
• Air travel
• Government
• Other
• Aerospace
• Air cargos

BY GEOGRAPHY
• Americas
• Europe
• Asia Pacific
• Middle East

500 SITA MEMBERS | 14 SITA BOARD DIRECTORS | 34 SITA COUNCIL REPRESENTATIVES

ALMOST EVERY INTERNATIONAL AIRLINE AND AIRPORT DOES BUSINESS WITH US. NEARLY EVERY PASSENGER TRIP RELIES ON OUR TECHNOLOGY.
Horizon Portfolio Overview

Access
- E-Commerce
- Mobile
- Kiosk
- Agent / corporate direct
- Airline agent desktop
- Partner & GDS distribution

Direct Sales and Service

Pricing
- Total Fares Management
- Analyse
- Manage
- Distribute
- Price
- Shop

Fast and accurate control of fares

PSS Core
- Reservations
- Inventory & RM
- DCS
- W&B
- Ticketing

Flexible, efficient Passenger Service Systems core moved off legacy

Services
- Profile & Loyalty
- Payments
- Ancillary Sales
- Intelligence

Shared services for all channels and customers
Scope of the Next Generation PSS Program

- **Touchpoints**
  - Desktop eCommerce
  - Mobile portal
  - Social media
  - Kiosk
  - Agent & Corporate direct
  - 3rd party Apps
  - Call centre
  - Check-in Boarding
  - Mobile agents
  - Cabin in-flight
  - GDS & Online agent
  - Partner & Alliance

- **Integration platform and enterprise service bus**
  - Merchandising
    - Marketplace
    - Service catalogue & fees
  - Pricing control
  - Price, re-price, refund
  - Flight shopping
  - Payment services
  - NG PSS administration

- **Retailing**
  - Reservations
  - Inventory & schedules
  - Fulfillment eTicket, EMD
  - Departure check-in & boarding

- **Primary services**
  - Loyalty
  - Revenue management
  - Revenue integrity
  - Revenue accounting

- **Related functions**
  - Weight & Balance

- **Data**
  - Customer journeys
  - Customer profiles
  - Inventory data
  - Schedule data
  - Seat data
  - Pricing/fee data
  - Reference data

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### Horizon Next Gen Program – Size

- Program estimation and sizing through formal analytics methodologies
- 5 year program with $155m development budget
- 102,000 Function Points (FP) in total for scope

<table>
<thead>
<tr>
<th>Other Development Programs</th>
<th>Function Point Counts *</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Air Traffic Control</td>
<td>306,000</td>
</tr>
<tr>
<td>Microsoft XP</td>
<td>127,000</td>
</tr>
<tr>
<td>Microsoft Office Professional</td>
<td>93,000</td>
</tr>
<tr>
<td>Airline Reservation System</td>
<td>38,000</td>
</tr>
<tr>
<td>NASA Space Shuttle</td>
<td>23,000</td>
</tr>
<tr>
<td>Google Search Engine</td>
<td>19,000</td>
</tr>
<tr>
<td>Travelocity</td>
<td>19,000</td>
</tr>
<tr>
<td>FEDEX Shipping Controls</td>
<td>17,000</td>
</tr>
<tr>
<td>Denver Airport Luggage</td>
<td>17,000</td>
</tr>
</tbody>
</table>

* Approx values for comparison purposes only
Next Gen. PSS Program: distributed organization

- **ARN** – Copenhagen
- **ATL** – Atlanta
- **BLR** – Bangalore
- **DEL** – Delhi
- **KBP** – Kiev
- **KUL** – Kuala Lumpur
- **LED** – St Petersburg
- **LON** – London
- **OMS** – Omsk

**All Software Development**
- ATL: Supplier
- ARN: Supplier
- LON/KUL: Supplier

**3rd party suppliers**
- ATL: Supplier
- LON: SITA
- YVR: SITA
- BLR: Off-shore partner
- DEL: Off-shore partner
- DEL: Off-shore partner
- KBP: Off-shore partner
- LED: Off-shore partner
- OMS: Off-shore partner

SITA QC

SITA Business Line

SITA Data Centre

Create success. Together
Why we needed to change

**Change drivers:** by Year 3 we were over spent and under delivered

- 50% budget spent and approximately 25% scope completed
- Delivery delays
- Technical debt build-up
- Quality issues

**Change vision:** we needed to be faster, on time, on budget

- Project acceleration to get back to 5 year plan
- Finite scope
- Engaged with 3 off-shore partners under same governance, responsible for development and testing prior to SITA acceptance testing
Agile Factory Model
Organization (shared responsibilities)
Key principles

- **Finite scope** and accurate **sizing**
- Clearly define and agree on the **Definition Of Done**
- Plan scope of work and resources ahead and **iteratively**
- Empower team to **self-manage** and take **ownership**
- Identical vendor structure, governance and **timings (heart beat)**
- Improve **continuously** through measuring and lessons learned
- Quality deliverables by discovering and **fixing problems early**
- **Continuous integration**: build **often**, integrate **often**, test **often**
Delivery process

Agile Factory Framework Boundaries

1. Requirements documented
2. Requirements & High Level Design completed
3. Software delivered passes Factory Acceptance Test
4. Software built and deployed
5. Acceptance, Integration and Performance Tests
6. Software Delivered for Demos / User Acceptance Test
7. Software Delivered for Production

Off-shore Supplier 1
Off-shore Supplier 2
Off-shore Supplier 3

SMEs BAs/BCs
Architects

Business Line (PSL, GSL)
SW Support & Maintenance
Quality

Continuous Integration

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Teams & roles

Cross-Functional Team (XFT)
- Plan the stages and iterations of the development program
- Provide Subject Matter Expertise (SME)
- Responsible for requirements and high-level design
- Interface with Offshore Core Team (OCT)
- Trust teams to self organize and deliver on commitment
- Manage teams not people (contracts are for teams)

Off-shore Core Team (OCT)
- Manage supply chain (input/output analysis and prioritisation)
- Manage Scrum Teams (number and work allocation)
- Shield Scrum Teams from management issues
- Roles and responsibilities aligned to functional domains
- Chief Scrum Master has full view of all Scrum Teams
- NFR Test Team do non-functional testing at module level

Scrum Teams
- Two (2) Scrum Teams per Scrum Master and per BA
- Focused on development and functional testing
- Daily Scrum Team meetings to feed into Scrum of Scrums
- Output continuously integrated and tested until ready for final verification and end-to-end testing
Acceptance, Integration and Performance

Criteria for Entry

- No Severity 1 or 2 defects
- Total defects severity 3-5 open against delivered have to be less than agreed upon metric
- User Story sign off
- # Function points planned/delivered

Deployment

Integration & Delivery

Acceptance, Integration, and Performance Testing (AIP)

Criteria for Exit

- No Severity 1s or 2s
- Customer & Development agreement on Sev 3 – 5
Iterative Software Delivery Framework

Stage X

Iteration X.1
- Elaboration - Sprint X.3
  - Cross-Functional Team
- Planning - Sprint X.2
  - Offshore Core Team
- Development - Sprint X.1
  - Offshore Scrum Teams
- AIP - Sprint X.1
  - QA Team
- End-to-end Acceptance, Integration & Performance Testing

Iteration X.2
- Elaboration - Sprint X.4
  - Cross-Functional Team
- Planning - Sprint X.3
  - Offshore Core Team
- Development - Sprint X.2
  - Offshore Scrum Teams
- AIP - Sprint X.1
  - QA Team
- End-to-end Acceptance, Integration & Performance Testing

Iteration X.3
- Elaboration - Sprint X.5
  - Cross-Functional Team
- Planning - Sprint X.4
  - Offshore Core Team
- Development - Sprint X.3
  - Offshore Scrum Teams
- AIP - Sprint X.2
  - QA Team
- End-to-end Acceptance, Integration & Performance Testing

Iteration X.4
- Elaboration - Sprint X.6
  - Cross-Functional Team
- Planning - Sprint X.5
  - Offshore Core Team
- Development - Sprint X.4
  - Offshore Scrum Teams
- AIP - Sprint X.3
  - QA Team
- End-to-end Acceptance, Integration & Performance Testing

Iteration X.5
- Elaboration - Sprint X.1.1
  - Cross-Functional Team
- Planning - Sprint X.6
  - Offshore Core Team
- Development - Sprint X.5
  - Offshore Scrum Teams
- AIP - Sprint X.4
  - QA Team
- End-to-end Acceptance, Integration & Performance Testing

Iteration X.6
- Elaboration - Backlog
  - Cross-Functional Team
- Planning - Sprint X.1.1
  - Offshore Core Team
- Development - Sprint X.6
  - Offshore Scrum Teams
- AIP - Sprint X.5
  - QA Team
- End-to-end Acceptance, Integration & Performance Testing

RELEASE X.1
RELEASE X.2
RELEASE X.3
RELEASE X.4
RELEASE X.5
RELEASE X.6

Elaboration
Review & Planning
Agile Development & Testing
Acceptance, Integration, Performance
Stage in detail (assembly piece by piece)
Resource capacity plan

Software delivery strategy and plan defined from:

- Partnerships with 3 offshore suppliers
- Agile methodology and principles
- Overall geographical distribution
- SITA’s capacity to produce Use Cases and Design Artifacts iteratively
- Offshore suppliers resourcing capacity and ability to produce software iteratively
- 3 theoretical scenarios based on risk management (scope vs. delivery process)
Estimation process

1. Program Scope (Use Cases) / Analytics Criteria
   → Program Sizing (Function Points*)

2. Program Sizing (FP*) / Productivity (hrs/FP*)
   → Total Effort (hours)

3. Total Effort (hrs) / Forecast Completion Date
   → Overall Resource Capacity Plan

4. Resource Capacity Plan / Prioritized Use Cases
   → Stage Scope (Use Cases)

5. Stage Scope (Use Cases) / Prioritized Use Cases
   → Sprint Scope (Use Cases)

* Definition of Function Point per UKSMA 1.3.1 - Mk II FP A
## Controls through metrics

<table>
<thead>
<tr>
<th>Daily Metrics</th>
<th>Sprint Metrics (trends)</th>
<th>Checklist of Dev. documentation</th>
<th>Product Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use case burn-down</td>
<td>• Automated unit test coverage</td>
<td>• Produced by OCT. Monitored and approved by SITA QA including test plan, design and test exit reports</td>
<td>• Defects found in Acceptance Integration or Performance: Categorized into Severity 1-5s</td>
</tr>
<tr>
<td>• Automated Coding standards checking</td>
<td>• Frequency of builds and runs of automated test suites</td>
<td></td>
<td>• Total defects per function point and KLOC</td>
</tr>
<tr>
<td>• Automated Unit Test results</td>
<td>• Use cases planned for Sprint compared to number done</td>
<td></td>
<td>• Requirements coverage by test cases executed</td>
</tr>
<tr>
<td>• Test case execution, passed against planned</td>
<td>• Manual functional test coverage (GUI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Defects</td>
<td>• Automated functional and non-functional test coverage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Communication

- Weekly webinars between XFT and OCT
- Webinars and video-conferences for planning, reviews and retrospectives
- Webinars and video-conferences for demonstrations of working software
- **Agile-Friendly offshore environment**
- **All documentation, source code and scripts shared in one central repository**
- SITA Delivery Management Team completed 6-8 site visits per module per year to each vendor
- OCT feedback the output of daily stand-ups, scrums and “scrum of scrums” to XFT via reporting of standard metrics and processes
- Multi-vendor OCT integration meetings twice per week
- **Key OCT resources based onshore alongside XFT**
What were the problems (1/2)?

• Difficulty for XFT to consistently “feed” offshore factories with required volume of quality requirements and design artefacts

• Excessive rework due to data schema and functional design changes (up to 40+% at peak time for 1 module, stabilized at ~25%, 27+% on average over 2 years)

• One offshore partner terminated half way

• Integration problems
  • Delayed and unavailable external components and services
  • Non-functional / buggy components and services
  • Changed service interfaces
What were the problems (2/2)?

![Chart showing stages and trends](chart.png)
## Agile Factory Model: vendor view

### Initial Concerns

- Fixed price contract for Agile projects
- Sizing based on function points
- Expected high productivity (<16 hrs/FP)
- High-level of testing coverage (100% of all functionality, >80% of all business logic)
- Continuous parallel functional, integration and performance testing as per Agile vs. after development as per Waterfall
- Continuous integration for modules developed by off-shore partners

### Outcome

- Time and material contract with service credits
- Function points are now the norm
- Achieved 15-16 hrs/FP (80% development life cycle)
- High-level of automated testing coverage (100% of all functionality, >80% of all business logic)
- Development and functional testing performed in parallel resulted in 60% less defects and defects found by SITA Quality post development, reduced from 70% to 15%
- Continuous integration, essential due to high number of scrum teams working in parallel, ensured consistent processes and practices
Recommendations & Thoughts
A few recommendations

| Set and communicate clear business and technical vision & goals, incl. minimum viable & marketable systems |
| Structure contracts based on framework and what (really) matters and needs to be achieved |
| Select carefully the Offshore Core Team (interview, frequent visits and reviews, changes early on as needed) |
| Define and implement a continuous build, integration & testing environment offshore |
| Define a clear common governance, incl. Definition of Done (DoD) at all levels |
| Define and implement an improvement program |
| Seed scrum teams while ramping up; keep the best resources while ramping down |
| Actively manage functional and technical dependencies |
| Track and manage productivity and quality metrics but... foremost the completion of business functionality |
More thoughts…

At first consider small to medium size/complexity projects ($<$5M/yr, with a small number of ext. dependencies)

Stage 0 (dictionary, foundation, prototyping, accurate project sizing) essential before application development

Business value-driven (top-to-bottom) plan & testing vs. Integration-driven (bottom-up) prioritization

Incremental (top-to-bottom) definition & design vs. Iterative (bottom-up) development & testing

80-20% rule (scope vs. effort; functional vs. non-functional design)

Contracts should be aligned with model & business goals, and should include a termination clause
Delegation works
Self-managing teams works
Common governance works
Continuous improvement works
Bottom-up management works
Continuous integration works
Distributed structure works

Agile Factory Works...!

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