The Agile Software Factory

Horizon Next Generation Development Program

John Flenley, Vice President
SITA Inc
Who are SITA?

“We don’t deliver garbage”
Who are SITA?

- **Société Internationale de Télécommunications Aéronautiques**
- Created and owned by the air transport community
- SITA is one of the world's leading specialists in air transport communications and IT solutions
- We deliver and manage IT solutions for airlines, airports, global distribution systems and governments.
- Almost every airline and airport in the world does business with SITA
- SITA works collaboratively with the air transport industry and the industry itself drives the company's portfolio and strategic direction
Horizon Portfolio Overview

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

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

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

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

Direct Sales and Service
Fast and accurate control of fares
Flexible, efficient Passenger Service Systems core moved off legacy
Shared services for all channels and customers
Scope of the Next Generation PSS Program

- Functions redeveloped in the current NG PSS programme
- Existing open modules integrated into NG design
- PSS related touchpoints

**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
  - Merchandising engine
- Pricing control
- Price, re-price, refund
- Flight shopping
- Payment services

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

**Related functions**
- Loyalty
- Revenue management
- Weight & Balance
- Business intelligence
- Revenue integrity
- Revenue accounting

**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
- 100,000 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
Change Program: A New Process
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
Why we needed to change

Change the process: a new way of working was needed

• Iterative large scale software delivery based on Agile
• Deliver functional integrated and performance tested solutions each iteration
• Continuous software build and integration
• SITA Quality Assurance for governance and validation

Change the plan: unify & simplify

• All Horizon Next Gen staff “reunited” with the Business and Software Development organisations
• Full-time SITA Integration Team
• Technical debt elimination
Program Delivery: Key Principles

- Define and agree on common **Definition of Done** (DoD)
- Deliver **working “shrink-wrapped” software** out of the Factory at each sprint as per agreed upon DoD
- **Empower cross-functional teams** to make decisions collaboratively and proactively, take ownership and commit to deliver working software at the end of each sprint
- Plan and execute software delivery **iteratively**
- Build, integrate and test **continuously**
The 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
Program Delivery: Resources

Software delivery strategy and plan defined from:

- Partnerships with 3 off-shore suppliers
- Agile methodology and principles
- Overall geographical distribution
- 3 theoretical scenarios based on risk management (scope vs. delivery process)
- SITA’s capacity to produce Use Cases and Design Artifacts iteratively
- Off-shore suppliers resourcing capacity and ability to produce software iteratively
Example Capacity Planning (1 Module)
Change Program: The Implementation
End-to-End Delivery Process

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
How did it work: Team Structures

SITA Cross-Functional Team (XFT)
Senior Delivery Managers, Project Managers, SMEs, Architects, Business Analysts, Testing and Continuous Integration

- Plan the stages and iterations of the development program
- Provide Subject Matter Expertise
- Feed off-shore factory with backlog of requirements and high-level design specifications
- Interface with Off-shore Core Team
- Trust teams to self organise 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)
- Protect Scrum Teams from involvement in day-to-day management
- Core team 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
50% Scrum Master
50% Business Analyst
1 Technical Lead
5 Developers
2 Testers

- Each Scrum Master manages two teams, each BA supports two teams
- Scrum Teams focus on development and functional testing
- Hold daily Scrum Team meetings which feed into Scrum of Scrums
- Output is continuously integrated and tested until ready for final verification and end-to-end testing
Governance through Metrics

<table>
<thead>
<tr>
<th>Daily Metrics</th>
<th>Sprint Metrics (trends)</th>
<th>Checklist of Agile 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 and monitored and approved by SITA QA including test plan, design and test exit reports</td>
<td>Defects found in Acceptance Integration or Performance: Categorised into Severity 1-5s</td>
</tr>
<tr>
<td>Automated Coding</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>standards checking</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>Automated Unit</td>
<td>Manual functional test coverage (GUI)</td>
<td></td>
<td></td>
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<tr>
<td>Test results</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Test case execution,</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>passed against planned</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Defects</td>
<td></td>
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</tbody>
</table>

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Communication

- Weekly webinars with XFT and OCT plus weekly forums for ad-hoc matters
- Webinars and video-conferences for stage planning, reviews and retrospectives
- Webinars and video-conferences for each sprint review including demonstrations of working software
- All documentation shared in one repository
- SITA Delivery Management Team completed 6-8 site visits 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 on-shore alongside XFT**
Software Delivery Framework

Stage X

- Elaboration
- Planning
- Development
- Acceptance, Integration, Performance

Release X.1
Release X.2
Release X.3
Release X.4
Release X.5
Release X.6
A Stage In Detail
Acceptance, Integration and Performance

Factory Agile Testing Cycle Flow

Criteria for Entry

- No Severity 1 or 2 defects
- Total defects severity 3-6 open against delivered have to be less than agreed upon metric
- User Story slip-off
- # Function points planned/delivered

Build and deployment of code drops received from suppliers

Acceptance, Integration, and Performance Testing (AIP)

Criteria for Exit

- No Severity 1s or 2s
- Customer & Development agreement on Sev 3 – 5
Acceptance, Integration and Performance

• AIP is run as sprints and match those of development. Sprint test execution is planned according to suppliers sprint backlog and quality control is one sprint behind development.

• Functional automation concentrates on services for inter-operability with other SITA products.

• Severity 1-2s are patched from development during the sprint; Severity 3-5s fixed in any agreed sprint for that release.

• Test cases are linked to requirements matrix to ensure full coverage or expose gaps.

• Sprint summary report is provided for progress on acceptance, integration and meeting performance required for user stories.

• Release exit report issued by SITA Test Manager.
AIP Acceptance Criteria

Criteria for entry into AIP

- No known Sev 1s or 2s outstanding on functionality for test
- Maximum 15% of Sev 3s outstanding on functionality handed over (or no more than 0.15 severity 3’s per function point and no more than 0.26 severity 3-5s per function point)
- 100% of planned test cases for functionality have been executed and 80% of planned test cases have passed
- Coding standards met and signed off
- Open defects per function point and KLOC against agreed threshold

Criteria for exit of AIP

- No known Sev 1s or 2s outstanding on stories/functionality
- No more than 0.15 severity 3’s per function point and no more than 0.26 severity 3-5s per function point
- 100% of planned test cases for user story/functionality have been executed
- 100% of functional requirements coverage by test cases
- Performance requirements are met
- Coding standards met and signed off
What were the problems?

- Excessive Rework
  - Inability to feed factory with volume
  - Quality of those artefacts

- External dependencies
  - Missing dependencies
  - Changed/redesigned dependencies
## Agile Factory Model: Vendor view

### Initial Concerns

- Fixed price contract for Agile projects
- Sizing based on function points
- Expected high productivity (<16 hours per function point)
- 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 hours per function point (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 40% 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
Program Achievements

• **Output and productivity increased** from 0.8% total program FPs per month, to 5% total program FPs per month.

• 29,000 FPs delivered in 12 months - as much as was achieved in the previous 3 years using Waterfall methodology

• **Average cost per FP reduced** from $2650 to $1100 currently, with a final target of $1,000

• **Quality increased** from 0.47 defects per FP to 0.29 defects per FP

• **Defects found** by off-shore suppliers (rather than SITA) increased from 30-50% to >85%

• 85% of the inherited technical debt absorbed at **no additional cost** (effort equivalent to the development of 1,700 FPs)
Summary

• **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**
• **Improve continuously** through measuring and lessons learned
• Quality deliverables by discovering and **fixing problems early**
• **Continuous integration**: Build often, integrate often, test often
Delegation works
Self-managing teams works
Common governance works
Continuous improvement works
Bottom-up management works
Continuous integration works
Simple structure works

Agile works
SITA Panel

• Aveek Dasgupta: Estimation and Analytics Specialist
• Patrick Holden: Program Director
• Declan Holmes: Director Delivery, Integration & Maintenance
• Olivier Poulard: Director, Software Development
THANK YOU

John Flenley
Vice President,
Software Development
john.flenley@sita.aero
www.sita.aero