Challenges / Guaranteed Outcomes On Perf. & Uptime

**Achieving Perf/Uptime**

**Challenge 1 | Achieve Best Perf. From Installed Assets**
OEE at Plant Level | Example From a Chemical Plant

- **Plant Availability Losses**
  - Max Theoretical Production: 100%
  - Planned Shutdowns: 5%
  - Unplanned Shutdowns: 5%

- **Plant Performance Losses**
  - Max Production: 90%
  - Performance Losses / Stoppages: 10%
  - Offspec Quality: 10%
  - Scrap Production: 6%

**Guaranteed Outcomes on Perf. & Uptime**

- **Sustaining Perf/Uptime**
  - Typical Performance Trend After Reaching Peak
  - Profits ($)
  - Peak Performance
  - Performance Degradation
  - LOST PROFITS

**Skilled Workforce**

**Challenge 3 | Aging Workforce & Knowledge Attrition**

- **Transition Creating Major Skills Gap**
  - Experienced staff set to retire in next 5 years

- **Aging Workforce**
  - % Workforce Min 20 Years in the Industry:
    - 2015: 25%
    - 2021: 18%
    - Retained skills: 12%

- **80%** Customers reporting challenges in prioritizing tasks for their skilled workers

**Guaranteed Outcomes**

- **Mitigate Twin issues - Skills Shortage and Prioritisation of Available Key Staff**

- **Challenge 4 | Service Programs Offer No Guarantees**
  - Agreed KPIs On Uptime & Performance
    - **Support KPIs**
      - 1. Response Time
      - 2. Resolution Time
      - 3. Incident Reduction
    - **Health & Perf. KPIs**
      - 1. System Health
      - 2. Application Health
      - 3. Application Performance
      - 4. Plant Performance

**Contractual Guarantees On Agreed KPIs**
Challenge 1 / Achieve Best Perf. From Installed Assets
OEE at Plant Level | Example From a Chemical Plant

Realise Higher Profits By Maximising Uptime & Getting Optimal Performance From Assets
Challenge 2 | Sustain Plant Performance

Typical Performance Trend After Reaching Peak

- **Objective of sustaining/tracking peak performance over the asset lifecycle**

![Graph showing typical performance trend after reaching peak with LOST PROFITS shaded area.](image)
Challenge 3 | Aging Workforce & Knowledge Attrition

Transition
Creating Major Skills Gap

Aging Workforce
% Workforce With More Than 20 Years In The Industry

- 2010: 29%
- 2014: 16%

Almost Halved In 4 years

50%
Experienced staff set to retire in next 5 years

12
Typical months when technology upgrade occurs

80%
Customers reporting challenges in prioritizing tasks for their skilled workers

Source: Hays Oil & Gas Global Salary Guide 2015

Mitigate Twin Issues - Skills Shortage And Prioritisation Of Available Key Staff
Challenge 4 | Traditional Programs Offer No Guarantees
Agreed KPIs On Uptime & Performance

Support KPIs

1. Response Time
2. Resolution Time
3. Incident Reduction

Health & Perf. KPIs

1. System Health
2. Application Health
3. Application Performance
4. Plant Performance

Contractual Guarantees On Agreed KPIs
In Summary | Customers Are Looking To…

<table>
<thead>
<tr>
<th>Achieve Optimal Perf. &amp; Uptime</th>
</tr>
</thead>
<tbody>
<tr>
<td>• System &amp; Application config/settings to unlock best performance</td>
</tr>
<tr>
<td>• Strategy and processes to leverage data insight and smart analytics</td>
</tr>
<tr>
<td>• Holistic view and control of plant across DCS, Advanced Applications, Servers, Stations etc</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sustain Optimal Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Minimise drift from originally designed plant/unit performance levels</td>
</tr>
<tr>
<td>• Minimise degradation of performance from Advanced Applications</td>
</tr>
<tr>
<td>• Ensure Adv. SW Apps are aligned to business objectives or changed operational conditions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Address Skills Deficit Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Not enough skilled people to undertake all required tasks</td>
</tr>
<tr>
<td>• Business often needs to redeploy key resources to other core tasks</td>
</tr>
<tr>
<td>• Increasing need for trained and competent external experts to augment in-house capabilities</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Guaranteed Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Guaranteed KPIs on system/Application Health &amp; Performance</td>
</tr>
<tr>
<td>• Guaranteed KPIs on support (inc. response time &amp; resolution time)</td>
</tr>
<tr>
<td>• Need for effective Change management to drive optimal benefits and ROI</td>
</tr>
</tbody>
</table>

Actively Managed through Assurance360
### A360 | Prog. Designed To Address These Needs/Challenges

<table>
<thead>
<tr>
<th>Governance Framework</th>
<th>Value Proposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>System + App. Health &amp; Performance</td>
<td>• Helps achieve <strong>optimal performance</strong> from installed assets taking a <strong>holistic approach</strong> to performance across different layers</td>
</tr>
<tr>
<td>Smart Analytics &amp; Data Insights</td>
<td>• Helps achieve <strong>best possible uptime</strong> by <strong>actively/proactively monitoring</strong> and controlling system and application health</td>
</tr>
<tr>
<td>Enablement</td>
<td>• <strong>Smart data</strong> visualisation and analytics support; System monitoring, <strong>Predictive &amp; Prescriptive (Rx)</strong> maintenance support</td>
</tr>
<tr>
<td></td>
<td>• Supported by a team of <strong>Subject Matter Experts</strong> (SMEs)</td>
</tr>
<tr>
<td></td>
<td>• Augments customer resources with <strong>Premium Support Centre (PSC)</strong> resources</td>
</tr>
<tr>
<td></td>
<td>• Health &amp; Performance reports enable customers to make <strong>better data driven decisions</strong> to achieve their business objectives</td>
</tr>
</tbody>
</table>
OEE MAX / Achieve Best Perf. From Installed Assets
OEE at Plant Level | Example From a Chemical Plant

Realise Higher Profits By Maximising Uptime & Getting Optimal Performance From Assets

Plant Availability Losses

- 6% [PS] Expert HON SME support to reduce planned downtime
- 2% [PS] HON Project Management expertise for turnarounds/shutdowns
- 2% [US] HON SME Support to troubleshoot & resolve incidents
- 2% [US] Smart analytics & Predictive Modelling to pre-empt failures before they occur

Plant Performance Losses

- 3% [PL] Proactive monitoring and intervention to improve performance
- 2% [PS] Smart applications & analytics to detect performance bottlenecks
- 2% [Q] Change mgmt. systems for quality
- 2% [Q] HON experts for quality control

Legend
- [PS] Planned Shutdown
- [US] Unplanned Shutdown
- [PL] Performance Loss
- [Q] Quality Loss

Max Theoretical Production

Planed Shutdowns

Unplanned Shutdowns

Max Production

Performance Losses / Slowdowns

Offspec Quality

Actual Production

100%

87%
Health & Perf. | Monitoring System Health

Level 0: SYSTEM
Overview of health Status

Level 1: SERVER
Aggregate score / indication

Level 2: LEAD INDICATORS
Top individual metrics

Level 3: SUB-INDICATORS
Sub-metrics

Level 4: DATA & INFORMATION
Sub-metrics trend and event plots

Typical examples of indicators and hierarchy

- **Server A**
  - Disk
    - Low disk space
    - System Read time
    - System Write time
    - Disk queue length
  - Disk Cache
  - Input bytes / second
  - Output queue length
  - Processor load
  - Processor interrupts
  - Processor queue length

- **Server B**
  - Network
    - Virtual memory
    - Available memory
  - Free page tables
  - Page files
  - Page/ non page bytes
  - Page per second

- **Server C**

Indicative Only
Health & Perf. | Monitoring Application Health

Level 0: SYSTEM
Overview of health Status

Level 1: Advanced Software Application
Aggregate score / indication

Level 2: LEAD INDICATORS
Top individual metrics

Level 3: SUB-INDICATORS
Sub-metrics

Level 4: DATA & INFORMATION
Sub-metrics trend and event plots

Typical examples of indicators and hierarchy

PHD
- Process leaks
  - PHD handle count
  - RDI handle count
  - API handle count
  - UDB handle count
  - Security handle count
  - PHD start handle
  - RAPI handle count
- RDI status
  - RDI state
  - Interface state
  - Point age
  - Point confidence
- Server status
  - Ping time
  - Lost connection
  - Con store failed
  - User count

APC
- Comms
  - OPC fail time / frequency
  - TPN load read / write
  - TPN interface queue
  - TPN HCI client connection
  - EPKS load read / write
- URT platform
  - Disk space Handle count
  - Controller handle count
  - Scheduling overlaps
- Application health

Indicative Only
Health & Perf. | Application Performance (APC Example)

Level 0: PLANT
Overview of Plant Performance

Level 1: UNIT
Aggregate score of unit

Level 2: LEAD INDICATORS
Unit metrics

Level 3: SUB-INDICATORS
Unit Sub-metrics

Key drivers for lost opportunity

Recommended Actions

Indicative Only
Real-time plant data with advanced software, analytics and plant process models to deliver operational improvements and increase reliability.

Delivery Architecture | From Traditional To Smart Delivery

Cloud Based Multi-Asset Model
“Digital Twin”

Customer SME
Iterative Optimization
Domain Expertise

Customer Site
High Speed Single Asset Model

Secured Data
Site Operations

Insights & Recommendations

Actions
Smart Analytics | Sample Output Profit Performance Mgr.

Connected Unit Performance (T1N4M4)

**Current Week Focus**

- Frequency and magnitude of Constraint Violations
- Actions / comments. Auto-generated from analytics and manually entered

**Long Term Performance**

- APC Value Lost Opportunity

**Key Variables**

- Actual Trend
- Potential Trend

**Equipment limit protection (Weekly)** (Week August/17 To August/24)

- COL OH COND OUTLET: 355.259, 30 C min
- COLUMN OVERHEAD PRESSURE: 20 % min
- WATER FROM C-4 BOOT -OP: 0 % min
- HGO TO E-23 VALVE OP: 20 % min

**Actions**

1. Follow up with CDU shift team leader on reasons for tube skin temperature limit change.
2. Follow up with CDU shift team leader on reasons for tube skin temperature limit change.
3. Follow up with CDU shift team leader on reasons for tube skin temperature limit change.
4. Follow up with CDU shift team leader on reasons for tube skin temperature limit change.
5. Follow up with CDU shift team leader on reasons for tube skin temperature limit change.

**Causes of Lost Opportunities**
## Enablement | 3-Tiered Comprehensive Support Mechanism

<table>
<thead>
<tr>
<th>Enablement Model</th>
<th>Performa</th>
<th>Optima</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Health</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrective</td>
<td>HON GTAC (phone &amp; remote secure connection)</td>
<td>HON GTAC (phone &amp; remote secure connection)</td>
</tr>
<tr>
<td>Predictive &amp; Preventive</td>
<td>PSC Recommendations &amp; Report handed to Customer</td>
<td>HON Resource actions PSC recommendations &amp; reports</td>
</tr>
<tr>
<td><strong>Performance Management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSC Recommendations &amp; Report handed to Customer</td>
<td>HON Resource actions PSC recommendations &amp; reports</td>
<td></td>
</tr>
<tr>
<td><strong>Competency Management</strong></td>
<td>Structured training program</td>
<td>Opportunity to learn on-job from <strong>on-site</strong> HON SME in addition to structured training program¹</td>
</tr>
</tbody>
</table>

1. Apprenticeship model when HON experts are on-site; Need to be agreed upon in advance
Note: PSC: Premium Support Centre, SME: Subject Matter Experts
### Guaranteed Outcomes | Additional KPIs For Advance Apps

<table>
<thead>
<tr>
<th>KPI</th>
<th>METRICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A  Advanced Process Control</td>
<td>▪ APC Performance Index (Weighted average of 7 attainment metrics + 3 user entered metrics)</td>
</tr>
<tr>
<td></td>
<td>▪ PHD Overall Effectiveness (Weighted average of Performance, Reliability &amp; Availability metrics)</td>
</tr>
<tr>
<td></td>
<td>▪ Indexed controller status:</td>
</tr>
<tr>
<td></td>
<td>1. Manoeuvrability</td>
</tr>
<tr>
<td></td>
<td>2. Usefulness</td>
</tr>
<tr>
<td></td>
<td>3. Criticality</td>
</tr>
<tr>
<td></td>
<td>4. Value</td>
</tr>
<tr>
<td></td>
<td>5. Acceptance</td>
</tr>
<tr>
<td></td>
<td>6. Reliability</td>
</tr>
<tr>
<td></td>
<td>7. Lost Opportunity</td>
</tr>
<tr>
<td></td>
<td>▪ Performance metrics (data/sql query latency)</td>
</tr>
<tr>
<td></td>
<td>▪ Reliability Metrics (collected tags data confidence, data availability, tags with range errors)</td>
</tr>
<tr>
<td></td>
<td>▪ Availability Metrics (derived from multiple individual metrics)</td>
</tr>
<tr>
<td></td>
<td>▪ 3 User defined metrics</td>
</tr>
<tr>
<td>B  Process Historian Service</td>
<td>▪ PHD Overall Effectiveness (Weighted average of Performance, Reliability &amp; Availability metrics)</td>
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<tr>
<td></td>
<td>▪ Availability Metrics (derived from multiple individual metrics)</td>
</tr>
<tr>
<td>C  Control Performance Monitor (CPM)</td>
<td>▪ CPM Performance Index</td>
</tr>
<tr>
<td></td>
<td>▪ Relative Perf. index</td>
</tr>
<tr>
<td></td>
<td>▪ Oscillation Index</td>
</tr>
<tr>
<td></td>
<td>▪ CMP (% normal, detuned, over-tuned, saturation)</td>
</tr>
<tr>
<td>D  DynAMO Alarm Management</td>
<td>▪ Alarm Performance Categorized into 5 (EEMUA 191 guidelines)¹</td>
</tr>
<tr>
<td></td>
<td>▪ Combination of several of alarm related metrics dependent on operational situation.</td>
</tr>
</tbody>
</table>

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1. Level 5 = Overloaded, Level 4 = Reactive, Level 3 = Stable, Level 2 = Robust and Level 1 = Predictive
## Business Model | Flexible To Meet Your Requirements

<table>
<thead>
<tr>
<th>Customer Profile</th>
<th>One Time Upgrade (OTU)</th>
<th>Competitive Displacement</th>
<th>OPEX Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HONEYWELL AS IB¹</strong></td>
<td><strong>Discount on One Time Upgrade (OTU) For Easier Entry To A360</strong></td>
<td><strong>Not Applicable</strong></td>
<td><strong>Not Applicable</strong></td>
</tr>
<tr>
<td><strong>COMPETITION IB</strong></td>
<td></td>
<td><strong>Discount To Reflect Residual Value Of Installed SW</strong></td>
<td><strong>Not Applicable</strong></td>
</tr>
<tr>
<td><strong>NEW INSTALLATION</strong></td>
<td></td>
<td></td>
<td><strong>OPEX Model</strong> Option for Periodic Payments to relieve CAPEX Pressure</td>
</tr>
</tbody>
</table>

1. IB (Installed Base = existing installation of Honeywell Advanced Software Application)

---

- **Customer already has HON Advanced Solution Licenses but the SW may or may not be most current**
- **Customer has competitive SW licenses installed on site which provide similar functionality as HON AS SW**
- **Customer is looking to add advanced applications to its installed base & is willing to purchase HON AS**
Outcomes | How Do We Define Outcomes?

Agreed Contract KPIs

Agreed Contract KPIs
- Individual KPIs are agreed upon and baseline established
- Not indexed on business revenue/profits

True Benefit Sharing (Profits/ Economic Sharing)

Indexed on Business results
- True profit sharing indexed on customer economic indicator(s) (results/cost savings etc)

[Indexing on Business Results]

102 %
Business Model | True Benefit Sharing Model Can Be Offered

Pre Commissioning Phase

Customer Economic Benefit ($)

Optima Pay-out ($) - Max. Optima Pay-out ($)

Performa Pay-out ($) - Max. Performa Pay-out ($)

Minimum Cost to cover installation & commissioning expense

- Optima pay-out is at a higher rate and a higher upper-limit threshold
- Performa pay-out is at a lower rate and hits the upper-limit threshold earlier
## Value Add | Continuous Push To Add More Value

<table>
<thead>
<tr>
<th>Service Node (SN) Connectivity</th>
<th>SPA In-app Analytics</th>
<th>Multi-source SPA</th>
<th>PDA App. Pred. Model</th>
<th>Premium Supp. Centre In-app Intelligence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enablers</strong></td>
<td></td>
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</table>

### Value Gap To Connected Offerings Will Grow

<table>
<thead>
<tr>
<th>SW/Sup Flex</th>
<th>VP &amp; BGP</th>
<th>VRP &amp; BGP+</th>
<th>A360</th>
</tr>
</thead>
<tbody>
<tr>
<td>✗</td>
<td>✗</td>
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<td>✓</td>
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</tbody>
</table>
## A360 | Unlock More Value & Move Up Service Maturity Level

<table>
<thead>
<tr>
<th>DESCRIPITIVE</th>
<th>DIAGNOSTIC</th>
<th>PREDICTIVE</th>
<th>PRESCRIPTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Describes problem</td>
<td>• Helps root-cause issues &amp; Speeds-up incident resolution</td>
<td>• Proactively avoids issues</td>
<td>• Answers “What mitigating actions to perform”</td>
</tr>
<tr>
<td>• Good for post-mortem analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Answer to “WHAT” Part of problem/issue</td>
<td>• Answer to “WHY” Part of problem/issue</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Answers “What Problems will happen &amp; When”</td>
<td></td>
</tr>
</tbody>
</table>

### Details
- System, App Logs
- Logs
- GTAC
- SPA
- PDA
- Premium Support Centre

### Performance
- Health
- Performance

---

Honeywell
THE POWER OF CONNECTED
## BENEFITS/FEATURES

1. Auto device discovery
2. Data Monitoring of controllers, computers, and other network devices
3. Alerting when defined criteria are met
4. Dashboard Display showing system status (in multiple ways) with drill-down for details
5. Intelligent, rationalized alerting to minimize useless alerts
6. Alert details and insights to facilitate alert remediation and risk mitigation

## VIEWS

- [Image of SPA feature demonstration]
- [Image of SPA feature demonstration]
- [Image of SPA feature demonstration]
PDA | Predictive Modelling To Pre-empt Issues

**BENEFITS/FEATURES**

1. **Server and Workstation degradation**
   - Memory leaks, Handle leaks, Driver memory leaks
   - Disk usage, consumption, high paging and thrashing
   - Processor degradation

2. **Control System Network degradation**
   - High traffic situation, Storm –(uni/broad/multi-cast)
   - Loop detection, MAC flapping

3. **Deviations from Benchmark**
   - Baseline system performance
   - Correlation benchmarking and deviation detection

4. **Descriptive analytics – Visualization**
   - Min, Max, Avg, Rate, Moving Average, Parameter Baselines

**DETAILS**

- Works based on data collected by SPA
- PDA will be cloud resident based on a SaaS model
- Would be a core entitlement for A360 Customers
- Premium Support Centre key to delivering PDA services
- PDA predictive models will continuously improve and seamlessly delivered to customers
**Secure Connectivity & Asset Lifecycle Management**

**Service Node Availability**
- Commission, configuration & on-going support of service nodes
- Ensuring SN is available and connected to all critical assets

**Secure Remote Access**
- Remote access and interventions as required to enable fast fix to incidents/problems
- Anti Virus and patch management to ensure system security

**Product Lifecycle Management**
- Regular updates of the install base against Honeywell product life cycle
- To flag any discrepancies, risk and input to migration plans as required

**Build validation**
- Baseline installed assets and provide recommendations to align them to Honeywell recommended standards

**Active Monitoring & Proactive Performance Management**

**Alert Mgmt. (Monitoring & Analysis)**
- Monitoring and corrective intervention if the system parameter value crosses threshold
- Recognise pattern for issues, (Bad Actors) triage & identify root cause and drive mitigating actions

**System Performance Analyser (SPA)**
- Commissioning and Configuration of SPA
- Active monitoring of site performance
- Proactive measures to ensure performance of installed site assets does not degrade

**Targeted Product Notifications**
- Deliver site specific notifications based on site assets for every quarter (BW, RAL and PNs)

**Predictive & Prescriptive Maintenance**

**Predictive Data Analytics (PDA)**
- Commissioning and Configuration of PDA
- PSC will be point of contact for PDA analysis
- Predict any incident failures using PDA tool

**Prescriptive (Rx) Recommendations**
- PSC will provide prescriptive measures and recommendations based on multi-sourced analysis of performance and health (system & application)
- Recommendations would help improve both uptime and performance of the installed assets as well as the economic performance of the plant as a whole
Industry 4.0 | HON Is Your Digital X-formation Partner

- **Secure cloud** Support, also enabling new business & asset deployment model
- **Honeywell Skills Insight**, intelligent augmented reality based helmets & glasses
- **Predictive Data Analytics (PDA)** to predict failures before they occur
- **System Performance Analyser** (SPA) for proactive system monitoring
- **Digital twin/simulation** for processes and assets
- **IoT platform**, Product dashboards e.g. A360 Dashboard
- **IIoT platform**, Product dashboards e.g. A360 Dashboard
- **Secure connectivity, Patch Delivery & AV updates using Service Node, ICS Shield, SMX systems**
- **Business System Integration** across different layers of automation systems
- **Cyber Security**
- **Cloud Enabled**
- **Intelligent Wearables**
- **Smart Data Analytics**
- **Proactive Sys. Monitoring**
- **Digital Twin**
- **Bus. Sys. Integration**
- **Industry 4.0**
Customer Profile | Is It Right For You?

1. **OUTCOME BUYER**
   - Customers looking to purchase on outcomes
   - A different Paradigm and NOT a combination of individual service programs

2. **WILLING TO CONNECT**
   - Connectivity Required to deliver additional benefits
   - Enables Predictive Modeling & Performance Optimisation

3. **COMMITMENT PARTNERSHIP**
   - Commitment Key To Realise Full Potential
   - Partners On Product Innovation Journey
Why Not You? | A360 Is Already Trusted By Leading Players