Helicopter Operations Monitoring Programme (HOMP)

A helicopter Flight Data Monitoring (FDM) programme

Shell Aircraft  smiths  BRISTOW HELICOPTERS  BRITISH AIRWAYS
What is Flight Data Monitoring?

Definition:
“A systematic method of accessing, analysing and acting upon information obtained from digital flight data records of routine operations to improve safety”

FDM involves the pro-active use of flight data to identify and address operational risks before they can lead to incidents and accidents
Why Flight Data Monitoring?

The Heinrich Pyramid

- For every major accident there are several less significant accidents, hundreds of reportable incidents and thousands of unreported incidents.

- Below this lie the normal variations present in all operations.

- FDM gives more detail on the incidents, encourages more consistent reporting and fills in the void below this that we know very little about.
Risk Management

Continuously identify and quantify risks

Are risks Acceptable?

Yes

No

Was action Effective?

Yes

No

Take remedial action

The “Closed Loop” Flight Data Monitoring Process
HOMP Trial Objectives

- Establish how best to monitor helicopter flight operations
- Evaluate the safety benefits of this monitoring
- Evaluate the tools and equipment selected for the trial, eliminate technical risks
- Establish a HOMP management strategy
- Assess the workload for a typical operator
- Obtain aircrew and management ‘buy-in’
- Further expose Industry to the concept of a HOMP
HOMP Aircraft System

CQAR

IHUMS DAPU (existing)

CVFDR (existing)

PCMCIA card

Download/Replay PC

Removed by maintainer at end of day’s flying
HOMP Ground-based System

2 Aircraft
REMOTE BASE (Scatsta)
Download PC
Regular data transfer

3 Aircraft
MAIN BASE (Aberdeen)
Replay & Analysis System

ES-S
Development
Back-up System

Program development
BA
Flight Data Analysis

- Event analysis
  - Detects exceedences of pre-defined operational envelopes and provides information on the extremes of the operation

- Measurement analysis
  - Takes a set of measurements on every flight and provides information on the whole operation
HOMP Analysis System

Flight Data Traces (FDT)
HOMP Analysis System

Flight Data Traces (FDT)

Flight Data Simulations (FDS)
HOMP Analysis System

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Flight Data Events (FDE)
HOMP Analysis System

Flight Data Traces (FDT)

Flight Data Measurements (FDM)
HOMP Analysis System

Flight Data Traces (FDT)

Flight Data Simulations (FDS)

Flight Data Events (FDE)

Flight Data Measurements (FDM)
Example HOMP Management Process

Flight data

HOMP OPERATOR:
Data Replay, Analysis and Verification

Changes to HOMP, Investigations

SAFETY OFFICER:
Review Meeting

Reporting of Trend information to Management and Staff

Changes to Procedures, Manuals, Training etc.

HOMP MANAGER (PILOT):
Assessment

Confidential Crew Feedback

Changes to HOMP, Investigations

HOMP OPERATOR:
Data Replay, Analysis and Verification

Reporting of Trend information to Management and Staff

Changes to Procedures, Manuals, Training etc.
Event example: Take-off with full right pedal

- Junior co-pilot flying
- Aircraft yawed sharply, pitched and rolled during lift-off
- Crew did not know what had gone wrong
- HOMP detected event and revealed the cause
- Autopilot engaged and gradually applied right pedal
- No-one monitoring the controls
- Almost full right pedal still applied at lift-off
- Danger of aircraft roll-over

![Graph showing Tail Rotor Pedal, Collective Pitch and Autopilot vs Time]
Event example: Inadvertent loss of airspeed

- Returning to airfield via low-level route
- Co-pilot decided weather unsuitable, initiated climb for instrument approach
- Aircraft now below MSA near terrain
- Co-pilot attempted to climb steeply to avoid terrain
- Airspeed below minimum IMC for 1 minute and reached 30kts
- Danger of loss of control

View showing loss of airspeed during climb
Event example: Takeoff with cabin heater on

- Heater must be off for takeoff and landing as there is single-engine performance penalty
- Many occurrences of heater being left on
- Offshore check list does not include this item
- A general bulletin was issued to aircrew
- Very few events subsequently occurred
- Decision not to add item to already long pre-takeoff checklist
- HOMP enabled action to be taken, then monitored the effectiveness of this action
Event example: Taxiing in rollover zone

- Rollover can be induced during taxiing
- Many events triggered, in several cases control positions were close to those in a previous accident
- Confidential feedback to crew, issue highlighted in a flight safety newsletter
- Only a limited reduction in events
- Second campaign, including memo to training captains and another newsletter
- Event occurrence rate dropped significantly
Event Trend Analysis

- Event trend data produced for a 6 month period
- Severity scale developed and severities allocated to events
- Top 5 events in terms of cumulative severity:
  - VNO exceedence
  - Autopilot left engaged after landing
  - Flight through hot gas
  - Excessive deck motion
  - Turbulence
- Trend information used to select items for a newsletter to aircrew

Cumulative event severities
HOMP events identified issues with:

- Pilot knowledge & skill
- Gaps in the training system
- Operating procedures
- Environmental operating limitations
- CRM
- Culture at remote operating bases
Measurement example: Mapping the environment

HOMP turbulence/workload data for Brae B

Old IVLL entry for Brae B

New IVLL entry for Brae B
Measurement example: Operating differences by installation

- HOMP data used to compare operations to different platforms
- Average of turbulence/workload parameter plotted by installation
- Chart shows top 9 and bottom 10 installations
- Top installations all have features explaining high parameter values

Average of turbulence/workload parameter by installation

Captain platform with large structure close to helideck
Measurement example: Operating differences by installation

- HGP
- Avg
- Chart
- Top

Average of turbulence/workload parameter by installation
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![Average of turbulence/workload parameter by installation](image)

Captain platform with large structure close to helideck
Measurement example: Offshore take-off profile

- Offshore take-off profile aimed at minimising risk of an accident due to an engine failure on take-off (exposure time)
- (1) Exposure to deck edge strike: Measurements checked adherence to Ops Manual advice on take-off rotation manoeuvre
- (2) Exposure to ditching: Measurements made of time to 35kts from rotation, which is greater than time to Vfly-away

**Maximum pitch angle (average = 10 to 11 degrees)**

**Time to 35kts (50% point on cumulative percentage graph= 4.5 secs)**
Measurement example: Offshore take-off profile

- (1) Exposure to deck edge strike: Measurements checked adherence to Ops Manual advice on take-off rotation manoeuvre
Measurement example: Offshore take-off profile

- (2) Exposure to ditching: Measurements made of time to 35kts from rotation, which is greater than time to Vfly-away.
Measurement example: Offshore vertical landing profile

- Night time vertical landing profile measurements implemented to support CAA helideck lighting research
- Six approach angle and height measurements made from 0.1 to 1.0nm from touchdown
- Mean approach angles at 0.3nm and 0.6nm from touchdown were 5.5 and 4.0 degrees respectively
HOMP feedback into training:

- HOMP lessons can be fed back into the training process
- HOMP information can identify areas for improvements in training (e.g. taxiing technique)
- HOMP events can be used to highlight key safety-related points (e.g. danger of loss of airspeed in IMC)
- HOMP data can be used to improve pilot technique (e.g. flying ILS approach)
HOMP feedback into engineering:

- HOMP enables continuous checking of FDR parameters
- HOMP data can be used to troubleshoot pilot reported problems (e.g. event created to trap intermittent engine fault)
- HOMP data can be used to assess structural impact of events (e.g. aircraft hit by line squall)
- HOMP data can be used to detect misuse which could impact reliability (e.g. excessive use of collective)
Example Implementation Costs

- **Start-up costs**
  - Per aircraft costs (including CQAR, mod kit and installation): typically no more than £10k
  - Ground based system costs (3 fleets, including hardware, software and configuration): typically no more than £80k
  - System introduction and commissioning

- **On-going costs**
  - Personnel (3 fleets): One full-time technician, one part-time HOMP Manager (1/3 time), one part-time Fleet Rep per fleet (1/4 time), Flight Safety Officer (1/4 time)
  - System maintenance and support
Summary

- The HOMP provided valuable new information on the risks associated with helicopter offshore operations.
- Events have identified hazards which otherwise would not have come to light.
- The operator has been able to take appropriate corrective and preventative measures.
- The measurements are building a useful picture of everyday operations which has not previously been available.
- The HOMP has shown how pro-active use of flight data in a FDM programme can significantly enhance the safety of helicopter offshore operations.
In Conclusion

- The HOMP successfully identified and addressed significant safety issues
- The HOMP trial demonstrated that it is a practical and cost effective flight safety tool
- The trial equipment was very reliable and effective
- The operator has implemented good HOMP operation and management procedures and aircrew response has been positive
- Because of this success, UKOOA has committed its members to implement HOMP on all UK offshore helicopters