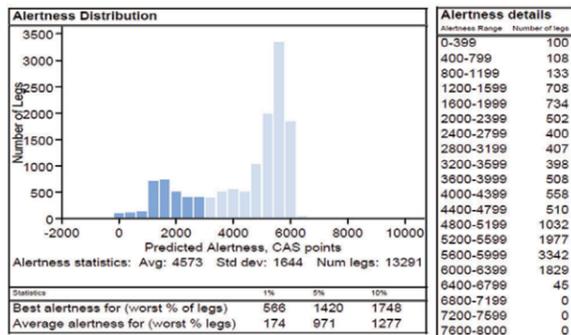


A Fatigue Risk Management System Visualized

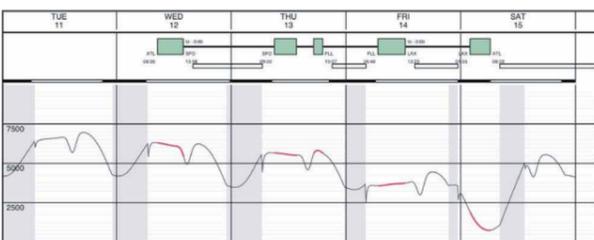
The ICAO definition of an FRMS: A data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge as well as operational experience that aims to ensure relevant personnel are performing at adequate levels of alertness.

1 In commercial aviation network planning, new flight schedules can be evaluated using a pairing optimizer and then compared with the predicted fatigue from previous periods. Scenario assessment is then performed using CFAS and tracked month by month for each crew rank.



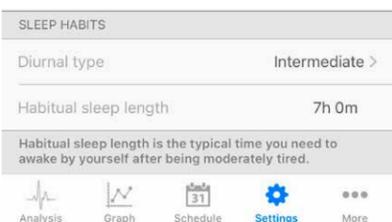
2 During planning, several pairing and rostering scenarios on the same flight schedule can be assessed using either:

- CFAS
- Direct influence by BAM building solutions that minimize fatigue
- Checks on individual patterns using manual modeling with CrewAlert



3 In day of ops, control of fatigue can be exercised through assessments over CFAS or direct model connection to BAM. This allows for evaluation of trip swaps or the selection of most suitable stand-by crew.

4 Crew, crew schedulers and scheduling managers obtain training from SMEs and the FSAG on basic fatigue science. CrewAlert can be used extensively to learn about reporting and more.

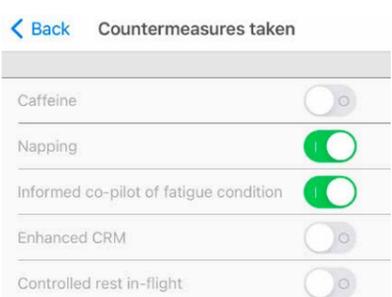


5 When receiving their rosters, crew can review which of their duties and flights are most likely to be fatiguing. This enables them to plan their sleep opportunities more efficiently.

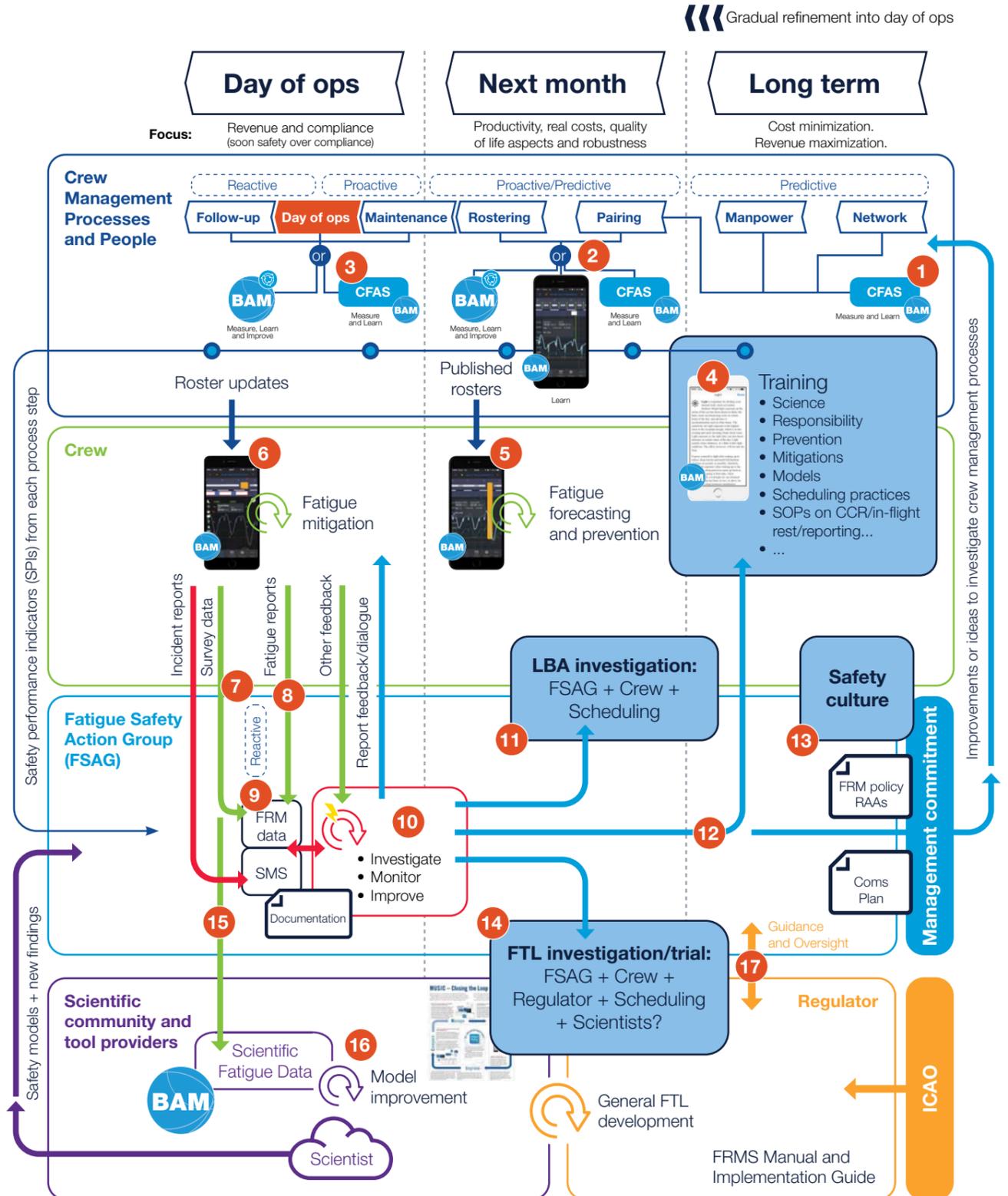
6 Using the fatigue mitigation advice functionality in CrewAlert, crew can get practical advice when in doubt on coping strategy.

7 Crew can use CrewAlert for collecting operational fatigue data in surveys initiated by the FSAG – reducing time and hassle dramatically.

8 Fatigue reports are easily issued and submitted in CrewAlert enabling best practice safety reporting but also minimizing the workload for crew and safety officers.



9 Collected data is stored and used together with other Safety Management System (SMS) data for analysis.



10 **The heart of the FRMS** is the Fatigue Action Safety Group (FSAG). This group is responsible for investigations, corrective actions, improvement work and documentation. They will also initiate changes to rules – Labor Agreements (LBAs) and Flight Time Limitations (FTL).

11 The LBAs and scheduling practices can be revised as a consequence of fatigue, but also for boosting efficiency. The planning department can assist with what-if's and measuring safety KPIs, like PA5 using CFAS/BAM.

12 The FSAG will use internal findings in addition to external influences from science to adjust training and SOPs.

13 The FSAG, together with top management, is responsible for creating a strong safety culture that encourages reporting of all safety related events to build actionable data.

14 As FTL exemptions are more frequently used, modeling and what-if's can monitor both safety and efficiency. An approval can be granted by a regulator for conducting a trial, followed by data collection showing an equivalent level of safety. The planning department can then model integration with scheduling tools to identify and tighten loop holes through reformulations of LBAs, FTLs and scheduling practices.

15 Sharing collected data allows Jeppesen and scientists to create advanced modeling based upon the best science possible. Fatigue surveys, where data is collected with CrewAlert, are automatically fed back to scientists and used for model validation and improvement.

16 Jeppesen has developed methodology for continuously improving BAM by continuously collecting data and collaborating with scientists.

17 An operator will be able to show the regulator:

- Statistics on fatigue reports including modeling for each report
- Continuous alertness predictions (per month and rank) on planned pairings and rosters, as well as actual rosters flown
- Strong and quantified safety cases on proposed changes on LBAs/FTLs
- Data collections from crew and correlation back to the model used
- An approach where the fatigue prediction model is changed/updated as better science becomes available
- The same science used throughout the process: planning of flight schedules + pairings + rosters, analysis of fatigue reports, in addition to advice for fatigue prevention and mitigation used operationally