Controlled Rest: Profile of Use, Challenges, and Best Practices

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Pilot Fatigue & Countermeasures

- Airline pilots often suffer from fatigue
- Fatigue Risk Management System (FRMS) and countermeasures are used to manage fatigue
- Controlled Rest (CR) is a “mitigation strategy to be used as needed in response to unanticipated fatigue experienced during flight operations” (ICAO, 2015)
  - Nap taken in-seat on the flight deck (c.f. bunk rest)
  - Defined policy and procedures to follow
  - Pilots must still be fit for duty
  - Approved by USAF, USCG and in most countries; not approved by FAA

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“Uncontrolled” Rest

Unintentional

- Up to 20% of night shift workers unintentionally fall asleep on shift (Coleman & Dement, 1986; Torsvall & Åkerstedt, 1987; Torsvall et al., 1989; Kecklund & Åkerstedt, 1993; Åkerstedt et al., 2002)
- 58% (N=713) Brazilian pilots reported unintentionally falling asleep while flying (Marqueze et al., 2017)
- 78% (N=7) pilots were observed having microsleeps during critical phases of flight; 44% (N=4) fell asleep during cruise (Rosekind et al., 1994)

Intentional

- Planned naps reported by US flight crew
  - 11% (N=3) long-haul pilots observed (Gander et al., 1991)
  - 56% (N=797) regional pilots surveyed (Co et al., 1999)
  - 39% (N=580) corporate/exec pilots surveyed (Rosekind et al., 2000)
  - “[CR] definitely needs to be legal. It’s being done anyway.” (Rice et al., 2018)

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Aug 3, 2009

CBS NEWS

NTSB: Both Pilots Asleep on Hawaii Flight

"The National Transportation Safety Board determines the probable cause(s) of this incident as follows:

- The captain and first officer **inadvertently falling asleep** during the cruise phase of flight.
- Contributing to the incident were the captain's **undiagnosed obstructive sleep apnea** and the flight crew's recent work schedules, which included **several consecutive days of early-morning start times**."

(NSTB Report SEA08IA080, 2009)

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Benefits of CR: Survey Data

- Managers and flight crew using CR (non-US)

(N=35; Holmes & Okuboyejo, in press)

  - 90% - “CR has provided significant benefits for flight safety”
  - 87% - “CR has reduced fatigue-related performance decrements during safety-critical phases of flight”
  - 83% - “CR has reduced the incidence of uncontrolled napping”

- US pilots

(N=30; Rice et al., 2018)

  - 70% approved or strongly approved of using CR in the US

Benefits of CR: In-flight data

www.nasa.gov

- N=21 pilots
- 40min nap opportunity
- 20min recovery period
- Polysomnography (PSG)
- Psychomotor Vigilance Test (PVT)
- Karolinska Sleepiness Scale (KSS)

Rosekind et al., 1994

Benefits of CR: In-flight data

- Sleep achieved in 93% of attempted naps
- Sleep Onset Latency (SOL) ~5min
- Total Sleep Time (TST) ~26min
- Increased speed; reduced lapses
- Reduced risk of unintentional sleep in cruise
- Eliminated microsleeps in critical phases of flight

www.nasa.gov

Rosekind et al., 1994;
Valk & Simons, 1997; Spencer & Robertson, 2000

Profile of Use (Non-US Carriers)

Survey Data

- 53% (N=134) pilots surveyed used CR in past 12 months (Petrie et al., 2004)
- Carriers with a fatigue reporting system and CR policy (N=2)
  - 30% of fatigue reports cite CR (Holmes & Okuboyejo, in press)

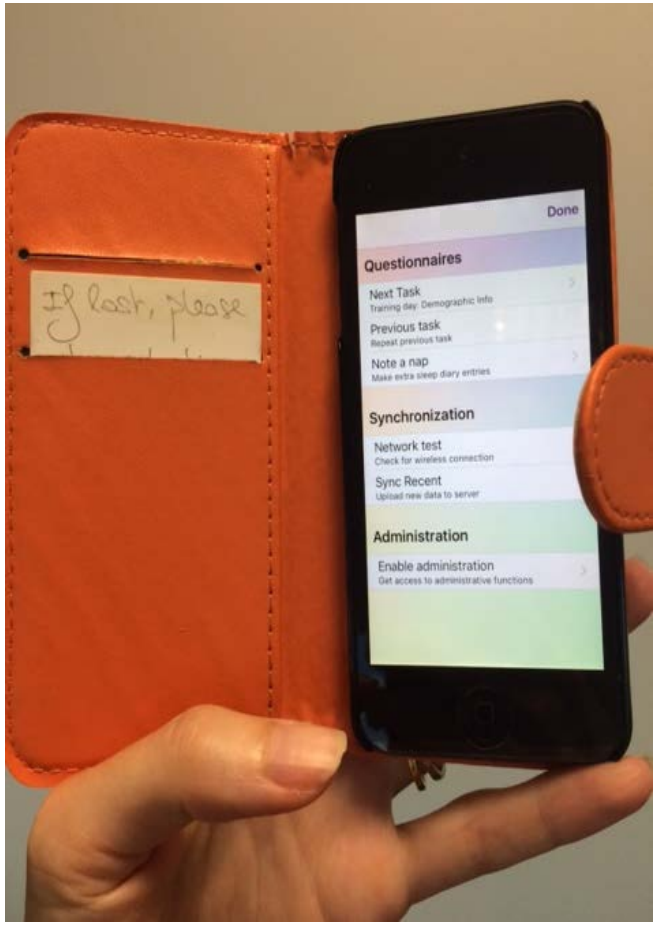
In-flight Data

- EASA Effectiveness of Flight Time Limitations Study (EASA, 2019)
- 24 airlines; 261 pilots; 2-week data collection
- 27% of night flights >10h contained CR

Profile of CR Use in Long-Haul Operations

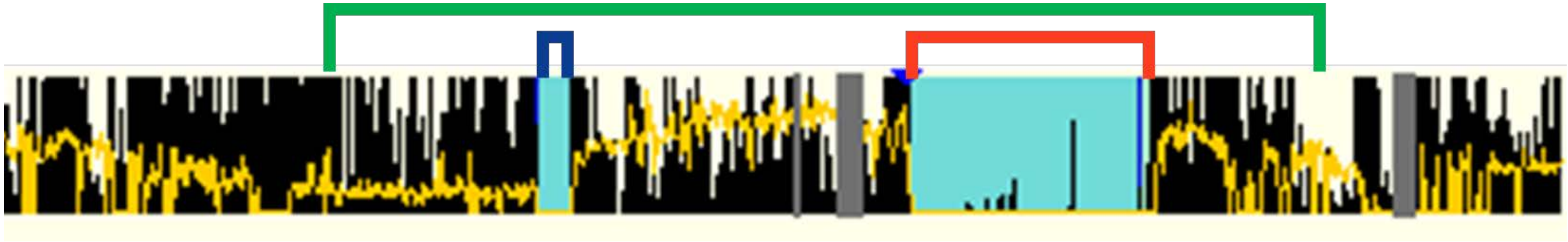
Personal photo

- N=44 pilots
- ~2-week data collection
- 239 long-haul flights
- App-based sleep diary
- Actiwatch
- Schedule info from operator



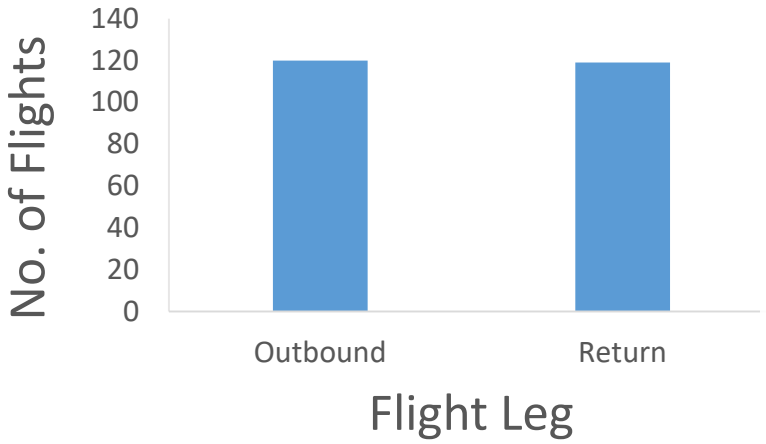
Personal photo

Actigraphy

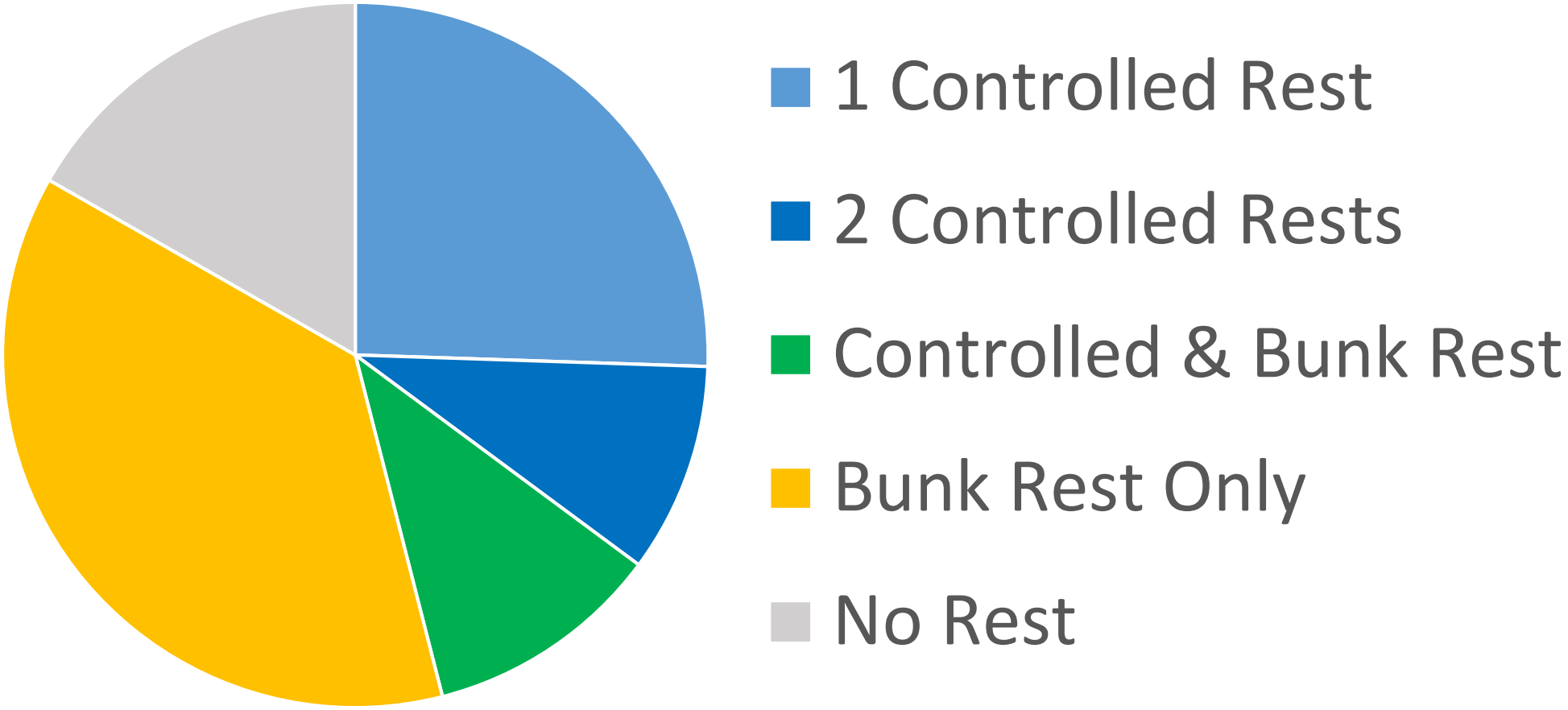


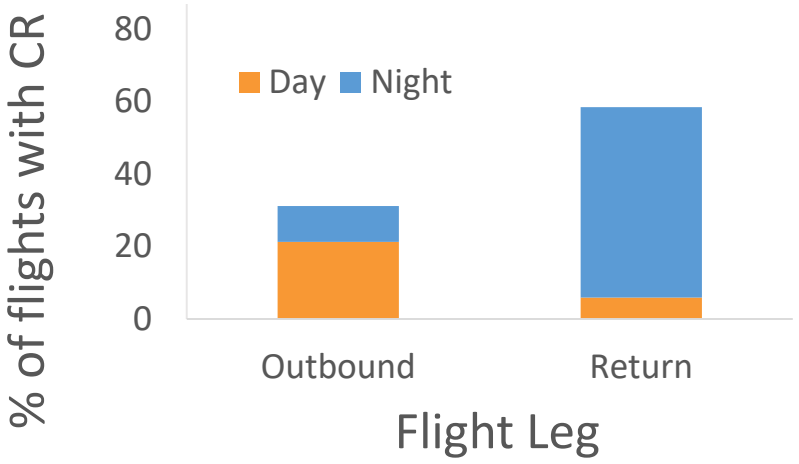
- Rest Periods based on sleep diary entry
- Sleep estimated using Actiware (Medium Wake Threshold)

Flight Summary

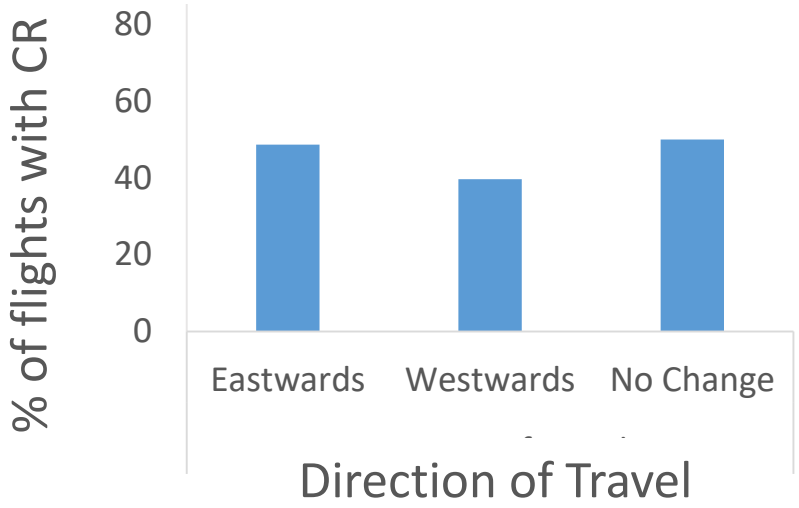


In-Flight Rest Summary




% of flights with CR
80
60
40
20
0
Day
Night
Outbound
Return
Flight Leg

<10h
>10h
2-pilot
>2-pilot
Crew Size


% of flights with CR
80
60
40
20
0
Eastwards
Westwards
No Change
Direction of Travel

<=8h
>8-10h
>10-12h
>12h
Flight Duration

Challenges

- Sleep inertia
  - Education, policy for recovery after nap
- Risk of other pilot falling asleep
  - Communication, planning, flight attendant check
- Public perception
  - Less willing to fly relative to No CR (N=530; Winter et al., 2015)
  - 86% (N=869) agreed that pilots should be able to nap (NSF Sleep in America Poll, 2002)
  - Education, public awareness campaigns to manage perceptions

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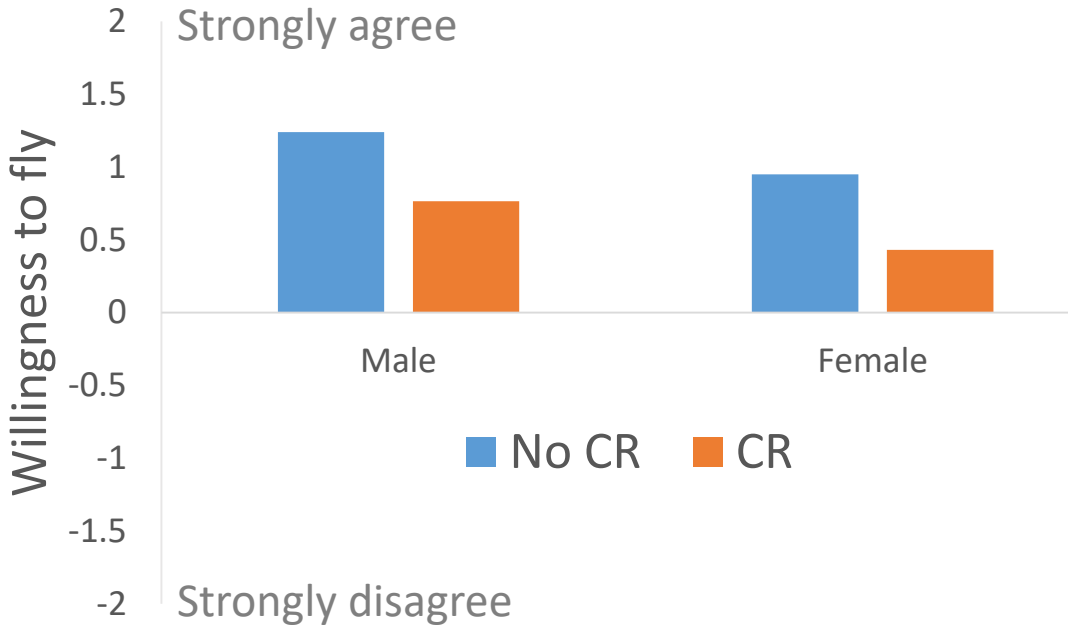
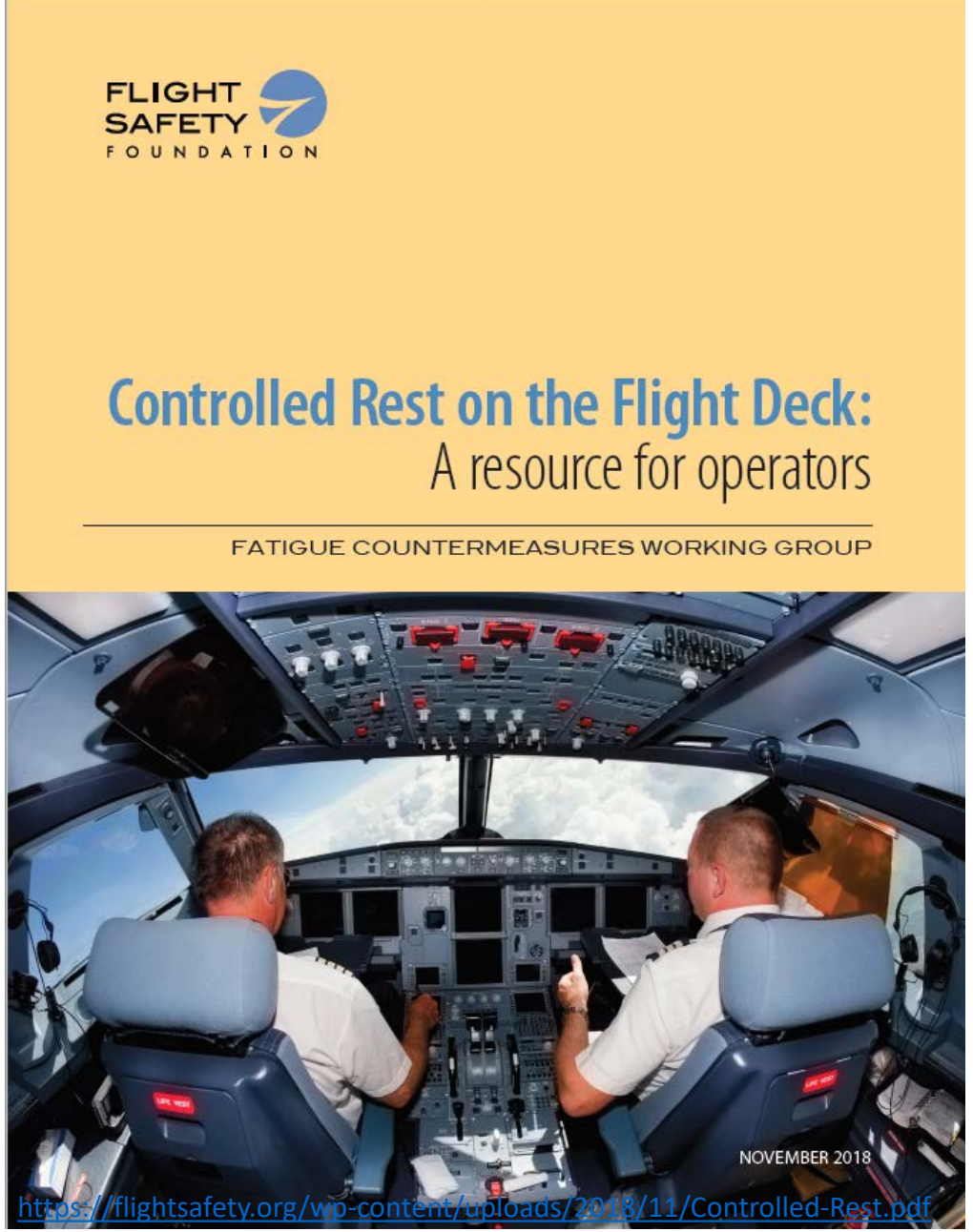


(Adapted from Winter et al., 2015)

Best Practice

Fatigue Countermeasures Working Group

- Sleep inertia and napping science
  - Nap benefits vary
  - Recovery period 20 min
- When to use
  - Low workload phase (cruise)
  - No abnormal situations
  - End at least 30min before top-of-descent (TOD)
- Minimum Safeguards
  - Handover briefing
  - Cabin crew check

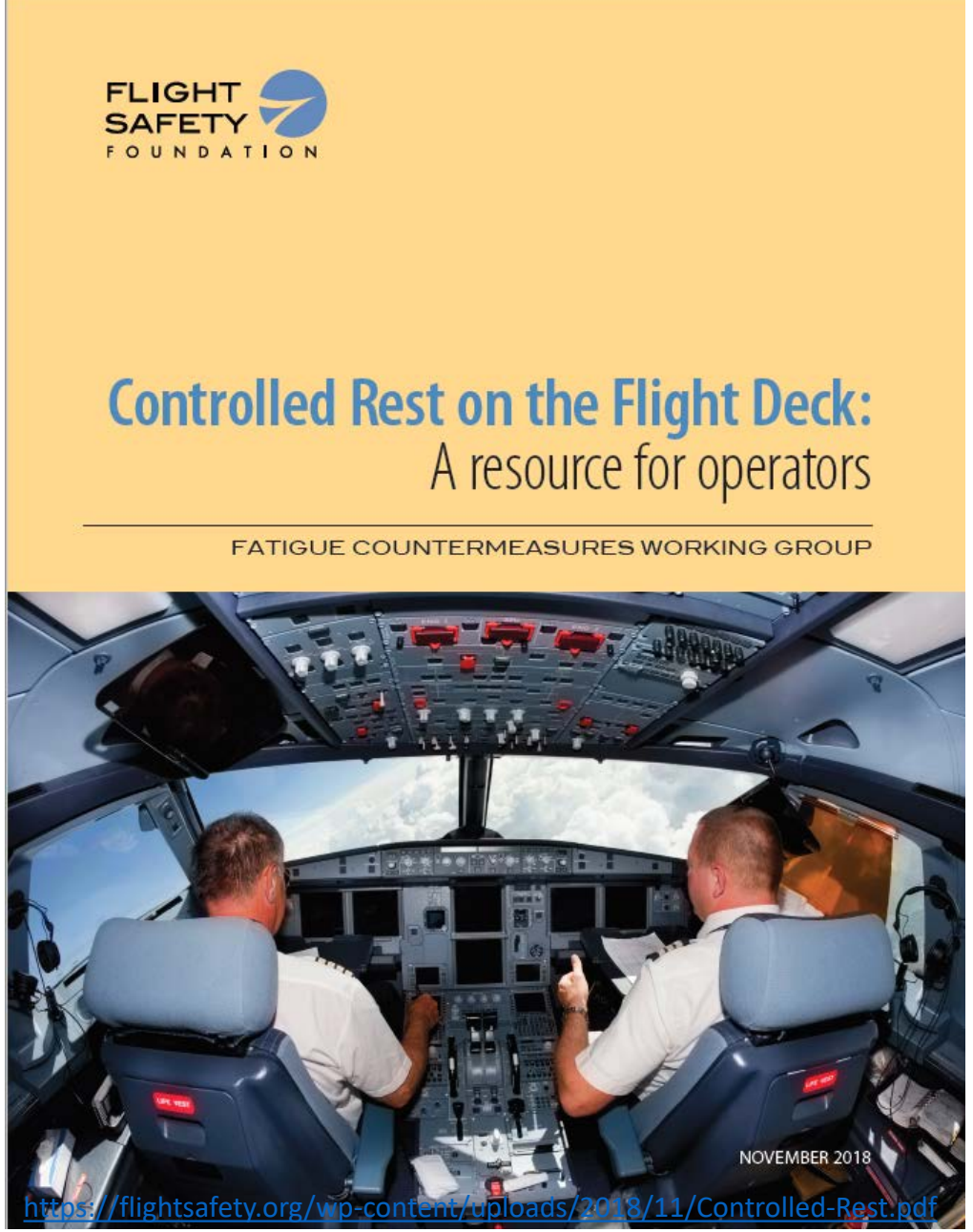


https://flightsafety.org/wp-content/uploads/2018/11/Controlled-Rest.pdf

Best Practice

Fatigue Countermeasures Working Group

- Education
- Integrate into Fatigue Risk Management
  - Report CR use
  - Identify trends
  - Develop management solutions
- CR is not a replacement for:
  - Requirement to be fit-for-duty
  - Best scheduling practices



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Summary

- In-lab and in-flight suggest CR can improve alertness and performance
- Naturalistic in-flight study of CR use show that is being used by pilots
- We need more data on CR in practice – how it's used; effectiveness
- Interested in learning more about CR; not advocating for it

Future Research

- Global Fatigue Countermeasures Survey of Commercial Airline Pilots (NASA and Fatigue Countermeasures Working Group)
- Investigate field-deployable countermeasures to sleep inertia (NASA, Central Queensland University, University of South Australia)
- Encourage airlines to collect data on CR to increase knowledge of use, attitudes, and effectiveness

Thank you

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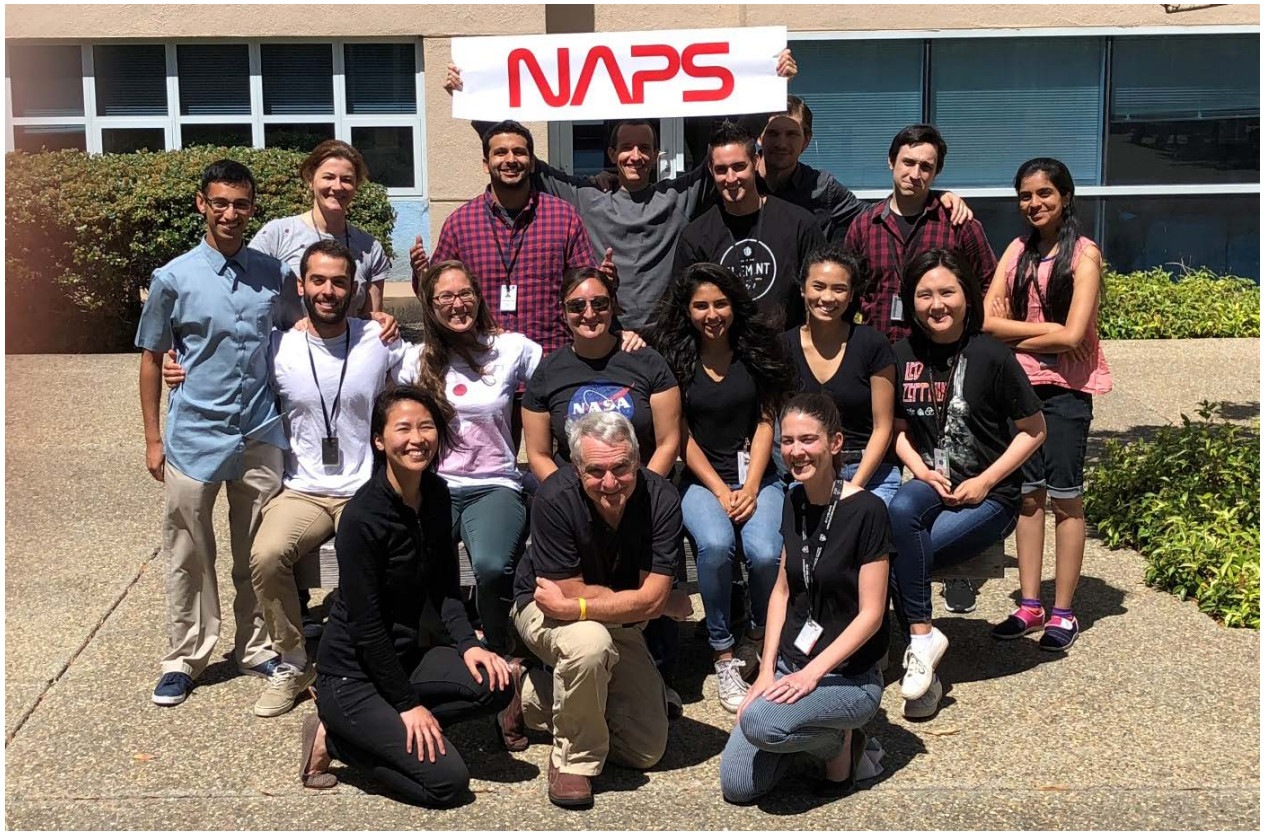
- Fatigue Countermeasures Lab (NAPS)
- Fatigue Countermeasures Working Group
- Erin Flynn-Evans
- Lucia Arsintescu
- Kevin Gregory



Personal photo

Support

- NASA Airspace Operations and Safety Program, System-Wide Safety Project